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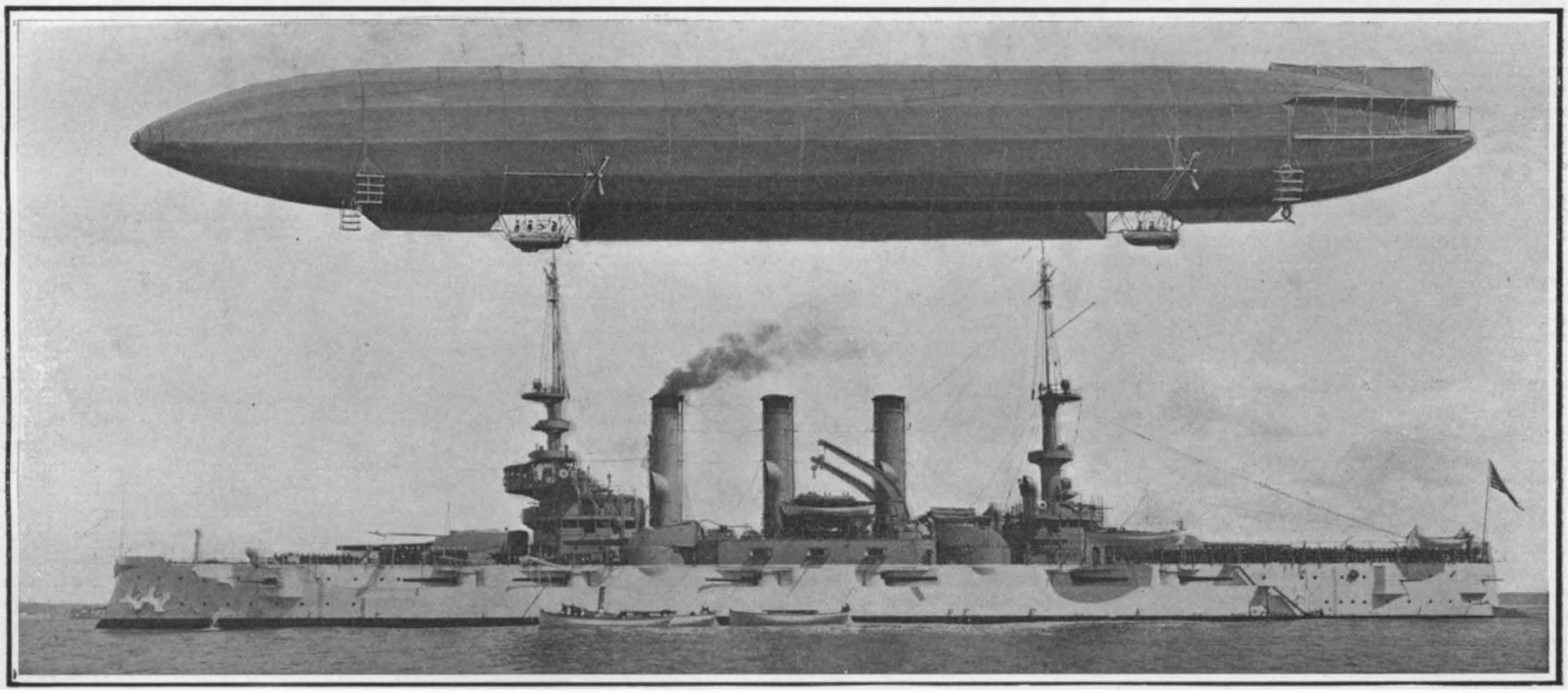

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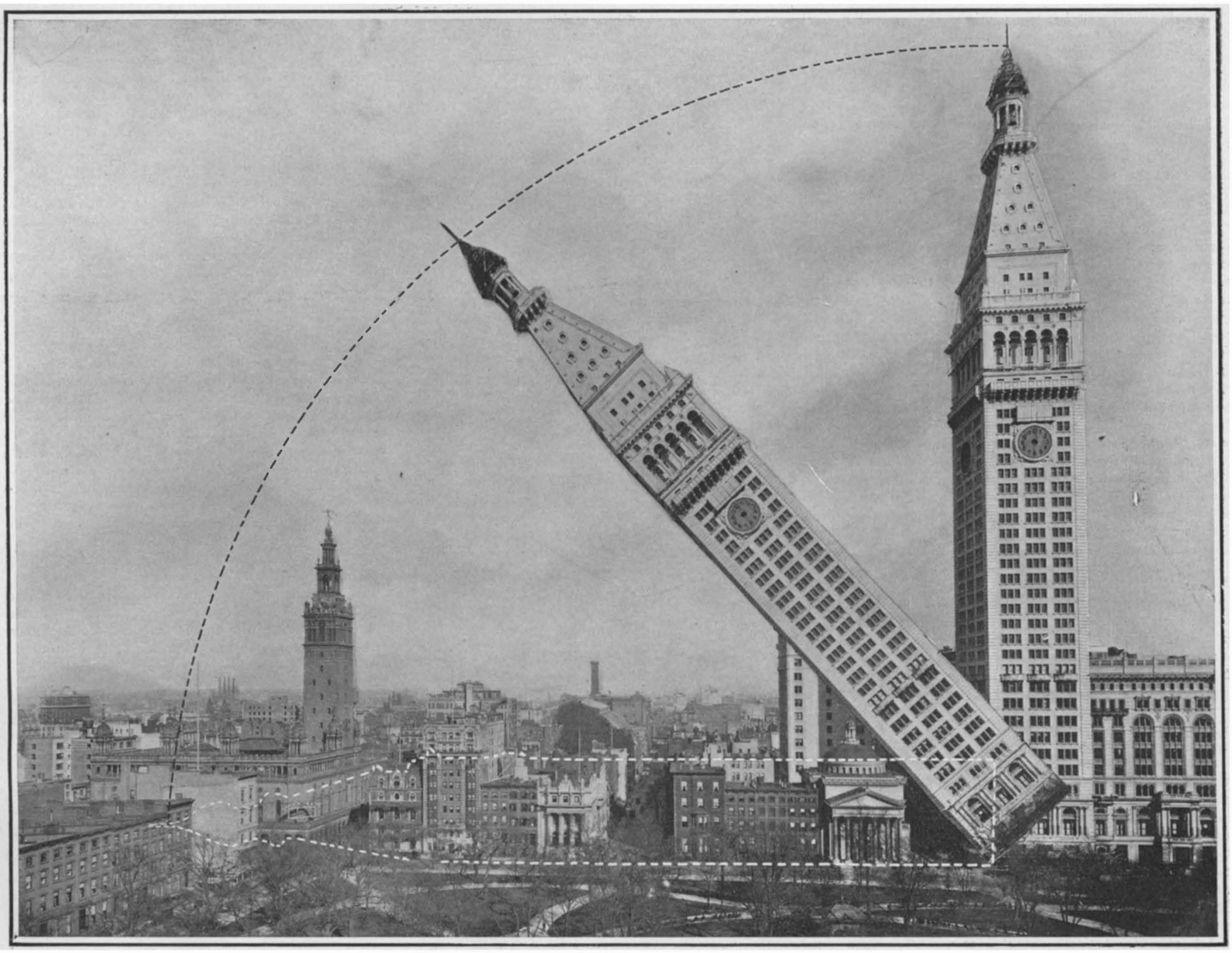
The "Zeppelin II" is nearly as long as the battleship "Louisiana."



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If the Metropolitan Tower were to fall, how far would it extend ?

THE METROPOLITAN TOWER AND THE "ZEPPELIN II."—[See page 478.]

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NEW YORK, SATURDAY, JUNE 26th, 1909

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.

BEARING OF THE SOO CANAL ACCIDENT ON PANAMA.

It was inevitable that the recent accident to the Soo Canal locks on the Canadian side would be cited by those who are opposed to the building of a lock canal at Panama, as affording the strongest kind of evidence of the truth of their contention that to construct a canal with locks at Panama is to invite a similar disaster and render the future security and permanence of the canal very precarious. We are quite willing to admit that, if the Panama locks were designed on the same plan, and if ships were to be allowed to pass through the locks under their own power as they do at the Soo locks, the point would be well taken, and it would be possible for a blunder upon the part of either the captain or engineer of a ship that was passing through to wreck the whole canal and put it out of commission for many months and possibly for one or two years.

In drawing the plans for the locks at Panama, however, the engineers have taken care to make certain provisions against disaster, both in the locks themselves and in the manner of controlling vessels that are passing through, which will render it practically impossible for an accident similar to that which occurred on June 9th in the Canadian lock to be repeated. To be convinced of this we make a brief *résumé* of what actually took place in the recent disaster.

The lock on the Canadian side is 900 feet long, 60 feet wide, and has a lift of 20 feet. At the time of the accident two ships were in the lock on their way down the canal. The waters in the lock were therefore on the same level as the upper reach of the canal. The upper gates were open, and the lower gates, being closed, were subject to the full head of twenty feet of water. At the same time, approaching the lock from below, was a steamship, the "Perry G. Walker." The captain had given orders to reverse the engines and stop the ship, but through some misunderstanding the engineer continued to go ahead. Before the ship could be stopped, her bow struck the lower gates, which were holding back under a head of twenty feet the waters of the lock and canal above, and smashed them down. Immediately the lock was changed into an open channel-way with a fall of twenty feet in nine hundred, and the whole mass of water in the upper reach of the canal commenced to sweep through in a raging torrent, wrecking the three ships that were concerned in the disaster.

Now the locks at Panama have been designed with a special view to the elimination of just such a disaster as this. In the first place, no ship will be allowed to approach or pass through the locks under the power of her own engines. On reaching the locks, either from above or below, she must be stopped several hundred yards from the structure. Then she will be taken in hand by powerful electric towing locomotives, running on tracks laid on the brink of the canal, some in front for towing, and others astern for checking the ship's way. The vessel, which will move at slow speed through the locks, will thus be held in absolute control. This will eliminate the present danger of a misunderstanding of signals between the captain on the bridge and the engineer below, either through a misreading of signals or a failure of the engine-room telegraph to work properly.

As a further provision against carrying away the gates, they will be built in duplicate with a wide stretch of water between; so that if by any chance the vessel should touch and break down the first gate, the water will be held by the gates beyond. These emergency or collision gates will be built of such strength that it will be impossible for a ship to break through them and reach the gates beyond.

Still another provision has been made against the escape of the waters of the lake, in the remote contingency of the ship getting away from the powerful towing engines and carrying away both the collision and water gates proper in succession. This consists in a massive swinging gate at the upper entrance, which, normally, lies up and down stream in a pocket formed in the side walls of the canal. The gate consists of a massive skeleton frame, carrying a line of sluice gates which, normally, are in the raised position. In case of an impending accident, the gate would be swung around across the channel and the gates rapidly lowered until they completely shut off the water. If no accident occurred, well and good. Should a lock gate be damaged, there would be a loss simply of the water in the locks, and the whole lock structure would be left dry and open for inspection and repairs. Even the most incredulous must admit that, with such provisions, with proper care, the possibility of the escape of the whole lake is not even remotely possible. It could take place only through the grossest negligence.

In the discussion of this problem we shall hear doubtless a great deal about the accidents which have taken place in past years both in the Soo Canal and in the Manchester Canal. It is true that on more than one occasion ships have collided with the locks and put the canals temporarily out of service; but we believe in almost every case disaster has been due to the always dangerous arrangement of separating the man who controls the ship from the man who controls the engine, and providing only an automatic means of communication between them. The elimination of this feature at Panama and the absolute handing over of the ship to the lock officials, who will have her in sight all the time, and will handle her from the shore by appliances whose motive power will be ample to control her speed and stop her at short notice, will render passage through the Panama locks a safer operation than that of many great engineering works which run from year to year without the least dislocation or disaster.

QUEENSBORO BRIDGE A SAFE STRUCTURE.

A few months ago we had occasion, in company with several other technical journals, to criticise the Bridge Department of this city, because the boards of engineers appointed to investigate the Queensboro Bridge found that, under the assumed maximum loading of 16,000 pounds per lineal foot, certain members in the bridge would be overstressed from 20 to over 40 per cent. These conditions were due to several causes, prominent among which was the addition of two elevated tracks on the upper floor of the bridge and certain changes in the paving of the roadway, etc., which together had made a considerable increase in the dead weight of the structure.

There can be no doubt that the public anxiety about the bridge, which had been very naturally awakened by the fall of that other great cantilever structure, the Quebec Bridge, was greatly aggravated by the facts presented in the reports of Prof. Burr and Messrs. Boller and Hodge, above referred to. In the interval since these reports were made public, the Bridge Department has followed the suggestion made by these engineers for reducing both the dead weight of the bridge itself and the live load which it will carry. The two additional elevated tracks have been removed; the footwalks, which were to have extended outside the trusses, have been placed above the stringers of the discarded railroad tracks; the enormously heavy concrete paving, which was not contemplated in the original plan, has been greatly reduced in thickness and lightened up. The result of these changes is that, if the traffic is subjected to the restrictions as to spacing of trains and crowding of teams, which obtain on other bridges, the stresses in the structure will be kept down within the limits of safe engineering practice.

In view of the fact that the bridge has now been formally opened to traffic, unusual interest attaches to a recent report on the structure made by Mr. F. C. Kunz, the chief engineer of the Pennsylvania Steel Company, who built the bridge. It is accompanied by a supplementary report by a commission consisting of two past presidents of the American Society of Civil Engineers, the engineer of bridges of the Pennsylvania, and the consulting engineer of the Baltimore & Ohio and Erie railroads. The commission draws attention to the fact that since the failure of the Quebec Bridge, public confidence has been disturbed as regards the safety of bridges of unusual magnitude, and that the distrust has been aggravated by the opinion expressed in the report of the Royal Commission which inquired into the cause of failure of the Quebec Bridge, who stated that "under extreme conditions the Quebec Bridge stresses are in general harmony with those permitted in the Blackwell's Island Bridge"—an "unwarranted remark," in the opinion of the commission.

Although there has never been any question of the excellent character of the steel and of the work of erection as done by the Pennsylvania Steel Company, both of the city's expert reports having pronounced the work to be "first-class," the present report may be regarded as an "apologia" of American principles of bridge design in structures of great size, with a criticism of the faulty application of one of these principles as applied in the present structure. It is impossible within the limits of the present article to give even a brief *résumé* of the report, nor is it necessary; but we wish to dwell upon one, and perhaps the most important, point made by Mr. Kunz, when he affirms that in adopting a theoretical live load of 16,000 pounds per lineal foot over the whole bridge as part of the basis data for the design, the Bridge Department erred on the side of caution. They adopted a loading which could never by any possibility occur in practice; which would involve a congestion so close that the movement of the traffic would be impracticable, a condition, in a word, which could only be realized by costly preparation and the assembling of the multitude of cars, vehicles and people by some carefully-thought-out plan.

In designing a bridge and calculating the amount of stress which must be provided for in each of its members, it is necessary for the engineer to determine what will be the weight of the structure itself and what the weight of the moving traffic and the wind and snow loads which it must carry. The first, which is known as the dead load, can be determined with great exactness, but the second is necessarily problematical. Not only will the amount of traffic on the bridge vary at different times, but it will vary in distribution. On some days it will be heavy, on others light, and on the same day and at the same time it may be heavy on one part of a bridge of the magnitude of the Queensboro and relatively very light on some other part. For these reasons the engineer has to assume or "guess at" the probable live loading of the structure. The customary and most reasonable plan in bridges of great magnitude is to assume the largest practicable or "working" load that could possibly be accommodated and kept moving on the bridge. This is known as the assumed live load. It is added to the known dead wind and snow loads, and the sum of these, as thus ascertained, is used in determining the proper size and strength of the various members of which the completed bridge will be made up.

Now it is considered by Mr. Kunz and the commission that in assuming the live load of the Queensboro Bridge at 16,000 pounds, or no less than eight tons, on every foot of the bridge, the figure was placed altogether too high. To produce a load of 16,000 pounds per foot, it would be necessary to load all the four elevated tracks with eight-car subway trains, with each train touching the one ahead of it; load the four trolley tracks with the heaviest surface cars placed bumper to bumper; load the 35-foot roadway from side to side and throughout the whole of its length with the heaviest motor trucks in use in the city, weighing nine tons apiece; and to crowd the footwalk with a mass of people packed together twice as closely as the crowd at the forward end of a North River ferryboat when it is approaching the slip.

Now since it is not conceivable that any condition, even of extreme panic, could induce a congestion approaching this, it is evident that had the Queensboro Bridge, as designed by the Bridge Department, been found to be able to carry such a load with safety, it would have been stronger, heavier, and more costly than the requirements of traffic could possibly call for. We do not say this to excuse the blunders of the Bridge Department; for having adopted a certain loading and a certain maximum unit stress, it was their duty to design the bridge compatibly with these requirements. In a matter of such serious moment as the design of a bridge of this character, the engineer cannot afford to play fast and loose with his data.

Although the errors were made and are quite inexcusable, it is in a sense fortunate that so high a live loading was assumed, since it has made it possible by taking off a certain amount of dead load to keep the stresses throughout the bridge well within the limits of what is considered to be conservative engineering practice.

In conclusion, then, the citizens of Greater New York may rest satisfied that, in spite of the mistakes which have been made, they possess in the lately opened structure a bridge which, although it does not possess the full capacity corresponding to the amount of material and money cost that has been put into it, nevertheless is perfectly safe for the loads under which it will henceforth be operated.

Arthur Wright has invented an electrical device for evaluating algebraical formulæ and equations. The device consists in the combination of special rheostats attached to slide rules and a Wheatstone bridge, by which quantities can be multiplied, divided, added, or subtracted simultaneously, and by which complicated algebraical expressions or equations can be evaluated or solved with an accuracy comparable with that attainable by ordinary slide rules.

ENGINEERING.

The contract has been awarded by the Navy Department to the San Francisco Bridge Company for the construction at Pearl Harbor, Hawaii, of what will be the largest drydock in the world. The masonry and cement portion of the dock alone will cost $1,670,000. Plans have been drawn for a complete system of defense for the harbor, and the construction of these defenses and of the dock will proceed simultaneously.

In a communication to Stahl und Eisen a German manufacturer states that he has succeeded in making satisfactory high-speed steels with powdered ferro-tungsten. The steel contains 0.85 of tungsten, 0.45 silicon, 0.45 manganese, 0.30 carbon, 0.25 aluminium, calcium, and magnesium, and 0.01 of sulphur. The powdered ferro-tungsten alloys more readily than tungsten metal, and there is less segregation and piping.

The French navy has suffered in the past from the lack of a systematic plan for the steady growth of the navy by regular annual increments. For the future the navy will be built up on the programme system first adopted by Germany. The new naval programme recently approved by the Cabinet involves an expenditure of $600,000,000, covering a period of ten years. Six battleships of the "Danton" type, six of the "République" type, and four armored cruisers of the "Gambetta" type are included in the estimates.

Apropos of the proposed deep waterway from Chicago to the Mississippi River, our esteemed contemporary Engineering News calls attention to the fact that a waterway between Lake Michigan and the Mississippi now exists across the State of Wisconsin, and that recently two steamers of considerable size passed through from the lake to the river. The route extends from Lake Michigan up Fox River, 38 miles, to and across Lake Winnebago, and through the upper Fox River 105 miles to the Portage Canal, which is 2½ miles in length. Thence it passes down the Wisconsin River, reaching the Mississippi near Prairie du Chien.

Now that the Board of Estimate has approved the application of the Hudson & Manhattan Railway Company for permission to extend its tunnels from Sixth Avenue to the Grand Central Station, New York, the company will push the work of construction with all possible speed. A delay of about six months will be occasioned by the work of obtaining property owners' consents, and it is estimated that the actual work of construction will consume about eighteen months, in which case trains will be running from the Jersey City terminals to the Grand Central Station early in 1911.

The question of the possible use of the electric furnace for the making of steel was discussed at the recent annual meeting of the British Iron and Steel Institute. Nothing has been done in this direction in a commercial way in England, though a small experimental furnace is to be built for Sheffield University. The system is being tried commercially at the Krupp works at Essen and Volklingen in Prussian Silesia. A few plants have also been installed in Sweden. Hitherto steel making by the electric process has not been tried on a commercial scale in this country; but we understand that one or two furnaces may possibly be included in the new Gary plant of the Indiana Steel Company.

The "Carnegie" non-magnetic survey yacht, the nature and objects of which were fully described in our issue of February 20th last, was successfully launched at the yard of the builders, the Tebo Yacht Basin Company, Brooklyn, on Saturday afternoon, June 12th. Work on the building of the boat has been rapid, and the rigging and equipment are expected to be even more so. The copper gas producer and auxiliary engines, refrigerators, galleys, and all other details are expected to be in place and brief trial trips concluded by July 15th, when the vessel will sail for Hudson's Bay. She will continue her magnetic survey work there until ice prohibits, when she will return to the Tebo basin, to be coppered before proceeding to southern waters.

Although a correspondent describing a Western tunneling machine in a recent issue suggested that nothing similar was being done in the East, the manufacturers of a machine for the same purpose have shown their confidence in it as a practical device by taking a contract for the boring of an 8-foot sewer tunnel under the Grand Central Station, New York, in the excavation adjacent to which the machine is now at work. This is the invention of Messrs. O. S. Proctor and E. F. Terry of the Terry & Tench Company, described in the SCIENTIFIC AMERICAN of January 9th. Whereas the trial is admittedly experimental as regards the best kind of steel and form of bit to be used, it has not developed as yet any essential defects in the machine, in spite of the exceptional difficulty of the task, a streak of quartz having been encountered in soft mica-schist, which makes cutting with such a machine more difficult than if the face of rock were uniformly hard.

ELECTRICITY.

Plans are under way for the electrification of the more important state railroads of Sweden. It is expected that the line running from Kiruna, in the iron ore fields of Lapland, to the Norway boundary will be the first to change from steam to electricity. The change is made necessary by the increase of traffic over the line, which can be handled only by doubling the tracks if steam propulsion be still adhered to. It is believed that electrification would be much more economical than the construction of double tracks.

A new method of testing insulation of armature coils has been devised, which is known as the "slot method." The dielectric is pressed into a laminated iron slot by means of a brass block. The block is connected to one terminal of the circuit, and the iron laminations to the other. An alternating current is thrown into the circuit, with a view to discovering the voltage at which a breakdown will occur. Owing to the angles in the laminated slot, there is quite a difference between the results of this system and the ordinary system of parallel plates.

The use of electricity for operating pumps in mines is attended with a high degree of efficiency when it is possible to use a large sump, which may fill during the working hours, and thus permit of deferring the pumping operation to those hours when the power plant is underloaded. Under such conditions the very best of steam plants cannot compete with electricity, for it is possible to use an approximately uniform load during twenty-four hours of the day, and the power companies make a low rate for such service.

One of the baseball grounds in Cincinnati has been equipped with electric lamps, so that it will be possible to play the game at night. The lamps are placed on tall steel towers surrounding the grounds, and searchlights directed upward permit the players and spectators to follow a fly ball that is batted high in the air. The illuminated grounds were tried out quite recently by one of the National League teams, and proved quite a success. It is predicted that illuminated baseball will become quite an evening entertainment, and should be very popular with those enthusiasts who are unable to get off of an afternoon to witness their favorite game.

A recent patent that should be of particular interest to electricians and plumbers covers a machine for boring holes through overhead beams, which does not require the operator to climb a ladder, but may be operated and directed from the floor. The machine is mounted on a staff provided with a foot which rests on the floor, and this staff may be adjusted to bring the boring tool against the ceiling or beam. The tool is operated by means of a hand crank, and the feed is regulated by a chain, both within easy reach of the operator. The device is arranged to bore a double line of holes.

An act recently passed by the Colorado Legislature makes it a misdemeanor for any person to tamper with electric wires or connections without the consent of the owner, or to meddle with an electric meter. A fine of from $50 to $300 and imprisonment for thirty to ninety days for failure to comply with this law, is the punishment. As it is rather difficult to fix the blame in ordinary cases, the act provides that the existence of a wire connection or any damage or alteration of a meter shall be taken as evidence of the guilt of a person in possession of the premises.

Now that an international candle has been fixed upon, it is unfortunate that Germany clings to its Hefner candle, particularly as the value of this candle is less than that of the new unit. It is believed that the public, not understanding the difference in the value of the candles, will be apt to buy the German lamps because they will bear a higher candle figure for the same value. Eleven Hefner candles are equivalent to ten international candles. The international candle is to be adopted in this country on the 1st of April next. Our standard candle will have to be reduced 1.6 per cent. That would make a 16-candle-power lamp of the present rating equal to 15¾ according to the new standard.

A very interesting electrical clock was exhibited at the Southern Electrical and Industrial Exposition held in Louisville, Ky. This clock is different from the ordinary in having no hands. Minutes are indicated by means of sixty radial rows of lights, each containing 32 electric globes. The hours are indicated by shorter rows of colored lights. In place of the hands, then, two lines of light sweep over the face of the dial, one indicating minutes and the other hours. Each second the illumination in an outer circle of lights moves forward one lamp, and when an entire circuit has been completed, the row of minute lights is advanced one interval. The hour hand moves at five-minute intervals. The dial is formed on the face of a huge pendulum, which swings to and fro over an arc of 15 feet. The pendulum is 48 feet long, and its weight, with the 5,485 lamps and 11,000 connections required, is 3,000 pounds. Over a mile of wire was used in making the connections of the clock.

SCIENCE.

In excavating for a drydock at Taranto, Italy, some interesting archæological relics were discovered. Among them were a sarcophagus of the fourth century A. D. containing two intact bodies, many valuable Ionic and Corinthian vases, sepulchral furniture, and a curious terra-cotta group representing Cupid kneeling on the shoulder of Venus.

We recently made the statement that there was no spectroscopic evidence of water vapor on Mars. We are informed by the secretary of Lowell Observatory that not only has the presence of water vapor in the atmosphere of Mars been spectroscopically detected by Mr. Slipher at Flagstaff, but that it has been photographed and the amount of water measured by Prof. Véry.

Although preparations were made at the United States Naval Observatory to observe the eclipse of the sun on June 17th, cloudy weather spoiled all the plans. Inasmuch as the eclipse was only partial in these latitudes, and total only near the North Pole, where few if any white men, with the exception of Commander R. E. Peary and his crew, are to be found, the eclipse was not of much astronomical importance.

Excavations conducted by the German Oriental Society have revealed the Palace of Herod on a hill south of Jericho. In Asur Nebo the temple erected by the last Assyrian king has been completely excavated, with the result that two smaller temples have been disclosed side by side. Lastly, the dwelling of an ordinary citizen was discovered intact, together with many earthenware bowls, utensils, and some tablets with inscriptions.

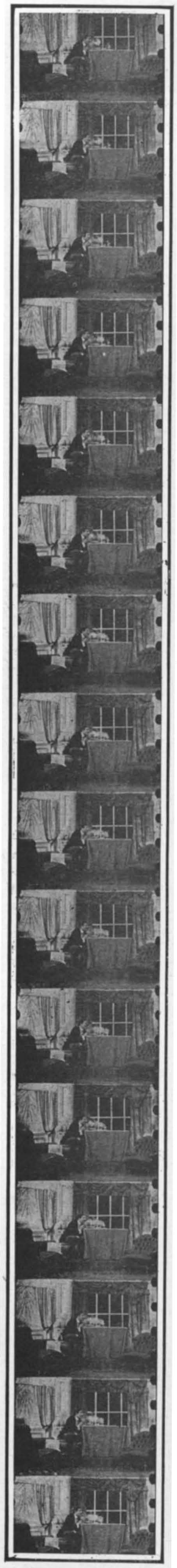
Col. Frank Touvelle, a rancher living near Medford, Oregon, is said to have produced a deep-rooted vine which brings forth three crops of berries in a season, which result has been obtained by grafting alfalfa roots on the roots of the strawberry vine. Alfalfa roots deeply and produces three to five crops a year without irrigation. It occurred to him that strawberries might do the same if the vine could be made to extend down far enough, so as to receive moisture from the soil throughout the season.

Dr. Jagot, of the Angers medical school, claims to have discovered the secret of the mysterious poison of the Borgias. Two poisons, apparently, were used, one slow and the other rapid in operation. The former appears to have been arsenious acid, commonly known as arsenic, which is only slightly soluble and therefore acts slowly, while the quick poison was probably one of the soluble preparations of arsenic which act almost instantaneously. It is not, however, positively proved whether the poison of the Borgias owed its efficacy to arsenic, to the ptomaines of putrefaction, or to both combined.

The rock temperature in Bendigo mines, according to the report for 1907 of A. H. Merrin, chief mining inspector for Victoria, Australia, increases at the rate of 1 deg. F. for each 75 feet below the zone of invariable temperature. At 4,000 feet the temperature due to the heat of the rocks is 110 deg. F. At this depth the temperature of the water issuing from the rocks is 114 deg. F. Under average underground conditions, when there is water in the downcast shaft, the actual temperature in the stopes will be somewhere between 75 deg. and 110 deg. F., depending upon the quantity of air entering the stope and the length of time the air is in contact with the rock before entering the stope.

The flow of sand through tubes has been studied by C. E. S. Phillips. It seems that the rate at which the free surface of a column of sand descends in a vertical tube, owing to the escape of powder from an orifice at the lower end, is independent of the head of sand above the opening. These experiments are intended to throw light upon the manner in which this result is brought about. By placing the powder in a D-section tube faced with glass, and arranging dark layers at regular intervals, the relative motion of the particles at various places is rendered visible as the column diminishes. The "gurgling" tube indicates, by the curious sound it emits, that the flow of sand takes place through it intermittently.

A new kind of glow in vacuum tubes has been discovered by the Rev. H. V. Gill, S.J. A vacuum tube is fitted up containing a small strip of palladium foil, or platinum foil coated with palladium black, mounted at the extremities of two leads, so that its temperature can be raised by means of an electric current. When the foil is heated in air at a pressure of about 0.15 millimeter to a white heat, there becomes visible round it a glow, not unlike the "negative glow" in a vacuum tube discharge. There is, however, no electric field except that due to the current employed to heat the foil. The glow is a rich purple-blue color, and is separated from the hot palladium by a dark space. There is evidence that the luminosity is due to a complicated reaction between the gases in the tube and particles of the disintegrated palladium.



Coquetting with the fairy.

SOME TRICKS OF THE MOVING PICTURE MAKER.

Moving pictures are exhibited in about ten thousand theaters and halls in the United States. With the rapid spread of this new amusement has also come a marked change in the public taste. When the moving picture first made its appearance as part of the programme of a music-hall entertainment, spectators were quite content with views of factory employees going to and coming from their work, the arrival and departure of railway trains, the passing of street parades, and similar scenes. Nowadays, a more or less coherent story must be unfolded, for which reason the maker of moving pictures has been compelled to write plays (or at least to conceive them) and to have them acted before the camera. Hence it is that every moving-picture studio includes in its equipment a company of about thirty actors or more, a stage manager or two, a stage with scenery fully as elaborate as that of the regular stage, together with all the paraphernalia of stage carpentry. As the art progressed, it was soon discovered that the camera was capable of performing miracles utterly inexplicable to the uninformed spectator, and hopelessly impossible of attainment on the regular stage. Thus, we find a milliner's apprentice transformed into a fashionably-dressed lady; a sleeping sot cut in two by an automobile and then put together again by an accommodating chauffeur with the aid of his tool kit; clowns mounting stairs backward and making amazing leaps; carriages which travel backward, dragging their horses with them; pumpkins rolling up a hilly street and leaping into upper windows; swarms of fairies springing from scattered roses; columns of vapor becoming transformed into radiant visions; and a host of other marvels which never fail to bewilder.

Some of the "properties" of the "Princess Nicotine." All are enlarged fac-similes of objects used in everyday life.

Through the kindness of Mr. J. Stuart Blackton and Mr. Albert E. Smith of the Vitagraph Company of America, we are enabled to give an explanation of the more important of these mysteries. In one film, which Mr. Blackton has conceived, entitled "The Princess Nicotine," nearly all the tricks of the moving-picture dramatist are utilized to the full, for which reason we cannot do better than to describe in detail the various scenes of this photographic play and to explain how its many startling effects are obtained.

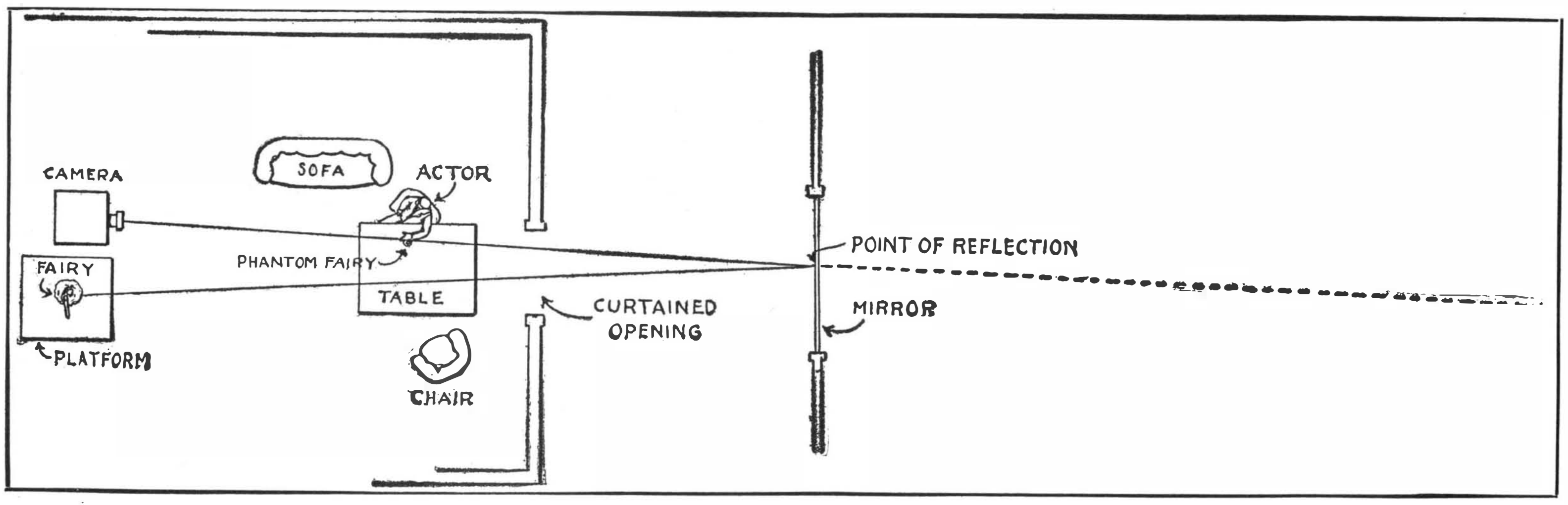
The artifices which are employed are all of them more or less dependent upon the fact that a moving picture is made by means of a camera, which takes photographs of animated objects on a film traveling past a lens at the rate of fifteen pictures per second. Almost all the tricks which can be played with the ordinary camera are also possible with the moving-picture machine. In addition, the film's motion can be reversed with curious effects. Thus, if a horse race is photographed with a moving-picture machine, it is a very simple matter to present the curious spectacle of the animals furiously racing back from the goal to the starting point, simply by causing the film to travel backward instead of forward. Double exposing, well known to every photographer, also explains many strange effects. What is known as the "stop motion" renders it possible for characters suddenly to appear and disappear. For example, by stopping the film and allowing a man to walk on or off and then resuming motion, a sudden appearance or disappearance is produced. On the screen there is no break at the point where the exit or entrance occurred, so that the spectator fails to realize the manner in which he was deceived. Sometimes the diaphragm of the lens is manipulated, in order that forms may gradually become definite or indefinite. The "stop motion" is likewise employed with great effect in giving life to apparently inanimate objects. Thus, it is possible for the spectator to see a lump of clay form itself into a bust of Washington, apparently without hands to mold it. The trick is done simply by stopping the film after each manipulation of the clay, and then resuming motion. The finished picture, which may have taken days to complete, is run off on the screen in a few minutes, and produces a truly staggering effect.

All these tricks of the moving-picture photographer, as we have said, are more or less embodied in the photographic play entitled "The Princess Nicotine." Its mysteries can best be explained scene by scene.

A man is disclosed sitting at a table. Before him on the table are a square tobacco box, a box of matches, a corncob pipe, a large round magnifying glass with a handle, a square white bottle standing on the square box, a vichy siphon, and a whisky bottle. The man fills his pipe, yawns, leans back, and falls asleep. The lid of the tobacco box opens, apparently of itself, and a fairy, Princess Nicotine, steps out, trips over to the pipe, points at it, returns to the box, helps out a smaller fairy, and motions her to climb into the pipe. As they are thrown on the screen, the figures of the man and the two fairies contrast by reason of their sizes. The man is life size, the fairies no bigger than his thumb. This peculiar effect of disproportionate sizes is produced by means of a mirror. The Princess Nicotine is an actress of average height. Her companion fairy is a little girl about twelve years of age. Both play their parts close to the moving-picture camera. They are reflected by a mirror placed far behind the table at which the man is sitting, the mirror being so arranged that it forms apparently one pane in a window. The reflection is caught by the camera, the lens of which is exactly flush with the top of the table, so that the images apparently stand upon the table. Inasmuch as the distance from the camera to the mirror is great, the two fairies are so reflected that they appear in very diminutive form upon the table. Thus, the illusion of miniature fairies is produced. Had the fairies been placed from the camera a distance equal to twice that of the mirror from the camera, the same result would have been produced. A mirror was employed simply to save space. The man in reality never sees anything but the table and the objects upon it.

The box opens of its own accord by means of a black thread attached to the lid. A pull upon the thread by a "super" standing out of range of the camera opens the box.

In the second scene the smaller fairy, with the assistance of Prin-



The stage setting of the "Princess Nicotine," showing the positions of the camera, mirror, and actors.

Blowing smoke at the fairy. In reality, the actor sees nothing on the table.

The fairy as the spectators see her. Steam serves as smoke.

The fairy entering the pipe with the assistance of the "Princess Nicotine."

Photographs copyright 1909 by Vitagraph Co. of America.

SOME TRICKS OF THE MOVING PICTURE MAKER.

cess Nicotine, pulls the tobacco out of the pipe. The smaller fairy then climbs into the bowl, disappears, and pulls tobacco over her. The Princess Nicotine returns to the tobacco box, climbs inside, closes the lid, raises it again, peeps out, laughs, and closes the lid again. To carry out this illusion, a corncob pipe and a tobacco box of gigantic dimensions are employed—the exact enlarged counterparts of the pipe and box lying upon the table in front of the man. By photographing only the two fairies and these huge properties and projecting the pictures upon the screen the spectators are apparently brought close to the table. Instead of tobacco, hay is employed, which on the screen looks for all the world like tobacco.

Presently the man awakens. He reaches for his pipe, and strikes a match. Try as he will, he cannot light the tobacco. He looks into the bowl. Snatching the magnifying glass, he examines the tobacco carefully.

The spectators suddenly take the place of the man, and apparently look through the magnifying glass with him; for upon the screen the magnified image of the pipe is thrown. A living fairy is disclosed peeping out of the big pipe, smoke rising around her. She laughs and points her finger. The effect is produced simply by photographing the girl in the large property pipe, and by blowing steam through the pipe so that it floats up around the girl and simulates smoke.

The scene is flashed back, and we see the man again at his table. He drops the magnifying glass, astonished, turns the pipe upside down, and knocks the ashes out on the table. He examines the tobacco through the glass. Again the enlarged image of what he sees through the glass is thrown upon the screen.

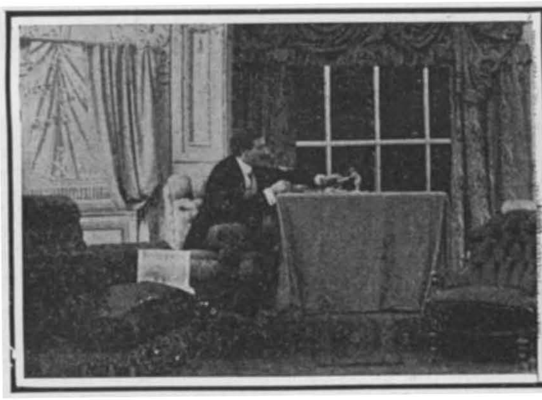
The inverted pipe is shown, immensely enlarged, apparently, with the smoking tobacco spilled out. The girl leaps to her feet, laughs, throws a kiss, runs to the tobacco box, opens the lid, leaps in, closes the lid, raises it again. She and the Princess Nicotine both point mockingly and laugh. In this transformation, the large property pipe is again used, and steam again serves as smoke.

duced of a rose plucking itself apart, dancing upon the table, and molding itself into a cigar.

After the rose has thus miraculously metamorphosed itself, the man returns. He picks up the cigar and lights it. The smoke rises, and then whirls rapidly around. Presently a huge cloud of smoke rushes into the white bottle standing on the table. To produce the effect of smoke rushing into the white bottle, steam is blown from under the table through a hole in the bottom of the bottle. On the screen the film is reversed, so that the steam (apparently smoke) instead of rushing out of the bottle blows into it.

Astonished at the very remarkable behavior of the smoke the man picks up the bottle and looks at it. The fairy is dimly visible within. Again he picks up the magnifying glass and peers through. Once more the spectators take the place of the man, and apparently look through the magnifying glass. They see the girl in the bottle, turning around and leaping up and down, knocking at the glass. This effect of the girl in the bottle is produced by means of a double exposure. In other words, a series of pictures is taken of the bottle alone, and another of the little girl's reflected image on the previously exposed film. Naturally, the girl must not move without a prescribed area on her platform beside the moving picture camera; otherwise, her reflection would fall outside of the bottle.

The man seizes the bottle by the top, and breaks the lower part with a hammer. The girl is revealed standing upon the box. She points to the man, and throws him a kiss. Stooping, she produces, apparently from behind the box, a package of cigarettes. She opens the package, takes out a cigarette, and hands it to him. He reaches for it, takes it, lights it, blows the smoke at her, and looks at her through the magnifying glass. The effect of the girl standing on the box after the bottle is broken is again produced by means of the "stop motion," the girl appearing at the proper moment when the film is stopped, and motion being resumed when she is in position. The package of cigarettes which she produces is in reality a huge



The actor taking the cigarette from the fairy.

The fairy offering the cigarette to the actor.

The man beneath the table blows smoke through the rose.

Once more the scene is changed. The man is seen at his table. The lid of the box is just closing. It opens once more. The Princess thrusts out her arm, and waves it playfully. The lid closes, leaving the arm protruding. The man seizes it. He pulls what he supposes to be the arm, opens the lid, and to his surprise finds himself holding a large rose. He smells it, coughs, and chokes; for smoke streams up from the center of the rose.

The effect of the closing lid is produced by a fine black thread manipulated by a man out of range of the camera. What is apparently the Princess' arm is a miniature property arm. The transformation of the arm into the rose is produced by a "stop motion." In other words, the camera is stopped, a rose substituted for the arm, and the motion resumed. In throwing the picture on the screen the "stop" is of course omitted, so that a miraculous transformation takes place. The rose has a hollow stem, which is connected with a rubber tube passing through the box on the table. A man beneath the table blows smoke through the tube.

Once more the man seizes his magnifying glass, and examines the rose. What he sees is again thrown upon the screen. The little fairy's head appears in the center of the rose, smoking a cigarette, and blowing the smoke laughingly. The rose of course is a huge property flower. Back the scene changes. The man drops the rose (a paper rose of natural size), frightened, and runs out. Presently the leaves detach themselves from the corolla, and commence to whirl around of their own accord toward the center of the table. Gradually they approach the center, and roll themselves up into a cigar. To produce this illusion, the "stop-motion" is again called into requisition. Each leaf is carefully plucked by hand. The stage manager moves the leaves of the rose just so far and no farther, steps out of range of the camera, and another picture is taken; and so on to the end. With the film flickering in front of the projecting lens at the rate of twenty pictures per second, the illusion is pro-

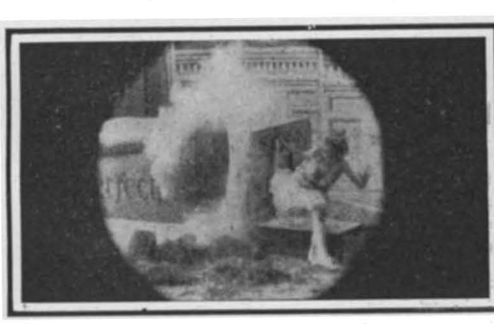
property package, as large as the girl herself. In the reflection it appears as small as a real package, so that the spectators are completely deceived. The cigarette which she removes from the package is a property cigarette, a yard long, and stuffed with hay. In the mirror it appears as small as a real cigarette. The effect of the man's taking the cigarette from her is again produced by means of the "stop motion," a real cigarette being substituted for the false.

When the man picks up the magnifying glass to observe the antics of the fairy after he has blown smoke at her, the scene is again changed, so that the spectators apparently look through the glass. The smoke in the magnified image is really steam, the illusion being heightened because the fairy coughs, shakes her fist, and stamps her foot in rage.

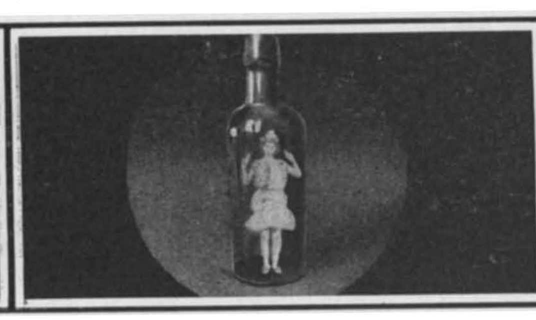
In the next scene the man is still shown blowing smoke. He takes a match, lights it, and holds it toward the fairy. She shrinks in fear. The man laughs, looks away, and blows out the match. In revenge the fairy stealthily creeps toward the match box. He watches her antics through the magnifying glass. In the magnified image the spectators see her opening the match box, taking out matches, and piling them up. She strikes a match on the box, and ignites the pile. The match box shown in the magnified image is a large property match box. The matches themselves which the fairy piles up are between two and three feet long, and are provided with paper heads which look for all the world like phosphorus in the camera.

When the scene is flashed back again to show the man at the table, the real matches (which have meanwhile been arranged in a pile) are shown blazing, with the fairy still bending down in the position of applying the match. The man seizes the seltzer siphon on the table, points at the blazing matches, looks through the magnifying glass. Again the spectators take the place of the man, and

(*Concluded on page 487.*)



The fairy shaken out of the pipe. The smoke is steam; the tobacco, straw.



The fairy within the bottle; an effect produced by double exposure.

The fairy in the center of the property rose.

Shaking the fairy out of the pipe.

Photographs copyright 1909 by Vitagraph Co. of America.

SOME TRICKS OF THE MOVING PICTURE MAKER.

THE METROPOLITAN TOWER AND THE "ZEPPELIN II" TWO STRIKING COMPARISONS.

Two very big structures which are more or less constantly in the public eye are the new Zeppelin airship, which recently met with disaster, and the Metropolitan Tower, which overtops every building in New York. Very few of us realize, perhaps, how huge the Zeppelin airship and the Metropolitan Tower are, largely because we must ordinarily deal with their dimensions in numbers. To present their immensity more forcibly, we have performed on our front page the photographic miracle of overturning the Metropolitan Tower and of floating the "Zeppelin" over the "Louisiana," one of our newest battleships.

The immensity of the tower is never more keenly realized than when the city of New York is viewed from the Orange Mountains of New Jersey. On a clear day, the white shaft rises magnificently in the sunlight to a height which justifies the title "Campanile of New York," that has been given to the building. Only to the suburban dweller is this spectacle vouchsafed. The thousands of New Yorkers whose peregrinations are confined to journeys on the street railways or subway from one end of the city to the other have few standards of comparison. They throw their heads back and wonder how high the tower is. For the benefit of these New Yorkers, we have photographically caused the building to topple and settle itself intact in Madison Square. The stupendous shaft of pure white marble towers to a height of 700 feet above the sidewalk. It has a base measurement of 75 feet by 85 feet. Madison Square extends from 23rd Street to 26th Street. If the tower were overthrown and laid on its side, as we have shown on our front page, the tip of the flagstaff which surmounts the summit would fall beyond the upper boundary of Madison Square, somewhere near 27th Street. The building is 85 feet wide on Madison Avenue, a width so great that were the building laid on its side, it would be impossible to see the dwellings behind it from Broadway. Only the cupola of the church on 24th Street would be visible. In other words, the tower is wider than an ordinary residence is tall, a fact which is probably not appreciated when we contemplate the lofty pile in its normal position.

We have previously had occasion to comment upon the height of this marvel of American tall building construction, and we cannot do better than to recapitulate briefly some of the facts previously brought out. Fully one-half of the tower looms above the skyline drawn by New York's cornices. So tall is the structure, that the snowy pinnacle catches the rays of the rising sun while the street below is still in darkness. When the sun sets behind the Orange Mountains of New Jersey, and the street lamps light up one by one, its rays will fall upon the top story of the Metropolitan Tower. It is a significant comment upon the height of the structure to state that the highest of the Montclair hills is lower than the tower by thirty feet. In other words, the man whose office is situated on the topmost story does his day's work on an artificial hill.

The Metropolitan Tower is the loftiest habitable structure in the world. For sheer height, however, it is surpassed by the Eiffel Tower, which is not an office building, and therefore hardly falls in the same class. The Zeppelin airship, on the other hand, stands without a rival in aeronautic hugeness. Since the craft was primarily intended for military use, it is but fitting to compare it with a modern battleship, for the "Zeppelin" is a warship of the air, even though it is not likely that it will ever be armed with guns, because of the enormous volume of explosive hydrogen carried in the gas bags. Absolutely accurate figures of the "Zeppelin's" size are not available, but from the best information at hand, we gather that the airship is 446 feet long, and that the diameter of the gas bag is 38 feet. That the "Zeppelin" is comparable in size with a modern battleship is fully borne out by one of our front-page illustrations, in which the craft is shown hovering over the United States battleship "Louisiana" in a position never likely to occur in actual experience. The "Louisiana" measures 450 feet on the water line, and 456¼ feet over all, so that a very good idea of the bigness of the airship may be gained simply by contemplating the "Louisiana." Unfortunately, the two vessels are so widely different in character, that further comparison is practically impossible. The battleship floats on water, the "Zeppelin" on air. A rather far-fetched comparison might therefore be drawn between the tonnage of the "Louisiana" and the lifting capacity of the "Zeppelin"; in other words, between the 16,000 tons of the "Louisiana" and the 7,062 pounds of the "Zeppelin." The result shows simply how little can be expected of an airship in carrying capacity, and how very necessary battleships will always be in order to carry heavy guns.

Death of Louis Prang.

Louis Prang died at Los Angeles on June 15th at the age of 85, while on his way to the Seattle Exposition. Mr. Prang devoted more than forty years of his life to the creation of standard colors, a problem that is of the utmost scientific importance. It is all the more remarkable that he should have succeeded so admirably, in spite of the fact that his education was not obtained in a university. When he was 13 years of age his father began training him in calico printing in Germany. In 1848 he fled to this country because of his affiliation with German revolutionists. He rapidly made his way in the lithographic art, and was soon regarded as one of the masters in his profession.

The Rapid Aging of Wines and Whiskies.

The mere fact that alcoholic beverages must be allowed to mature for a period frequently extending over many years, naturally raises the question: Why is it not possible by chemical means to produce the same effect in the laboratory in a very much shorter time?

The idea is not new, for attempts innumerable have been made in the last one hundred years to cure distilled liquors of their "rawness." It can be safely said that they were never completely successful. A method which applied excellently to one liquor, failed utterly when applied to another. It was not until organic chemistry had advanced so far that the nature of the substances which are usually grouped under the title of "fusel oils" was known, and their reactions studied, that a successful method of aging liquors artificially could be hoped for. It is now recognized that the disagreeable odor and taste of a newly distilled liquor are due to a group of higher alcohols in the "fatty" series, amyl alcohol being the most prominent. There are besides buryl and capryl alcohols, and corresponding acids in the free state. The organic chemist found that by storing liquor for years, the higher alcohols are transformed into "esters" by combination with the acids. The old idea, which still finds expression occasionally in books, that the "fusel oil" is gradually removed by the charcoal lining of the charred casks, is quite wrong, for it has been found that in some cases old brandies contained even more fusel oil after long storage than when freshly distilled. It seems that the more agreeable flavor of an old liquor is due entirely to chemical changes produced by time, among which is the transformation of the free higher alcohols into aromatic "esters."

It remained for the late Mr. James Howden, a Scotch chemist, to apply the discoveries made in organic chemistry to these baffling problems. His process, which has been patented both in this country and abroad, is based upon the fact that the water solutions of the alkyl-acid salts, of potash and lime bases, can be boiled for protracted periods without allowing the alcohols to escape. He first thought of trying this principle to the improvement of inferior grape brandies. He first digested the raw brandy for a suitable time at temperatures ranging from 120 to 160 deg. Fahr. with the addition of a fraction of one per cent of sulphuric acid. The raw flavor was promptly removed by the acid. After lime carbonate was introduced to neutralize the acid, the distillate was immediately salable and quite free from rawness.

An investigation of Mr. Howden's process has been made by distinguished chemists and alcohol technologists, among them Prof. E. W. Hilgard of the University of California, and the experts of the Internal Revenue of the United States. It seems to be the general consensus of opinion that Mr. Howden succeeded in solving a problem which has so long perplexed the distiller and the chemist.

The Howden process is applicable not only to brandies, but to most other distilled liquors as well, with modifications depending upon the nature and amount of their respective flavoring compounds or fusel oils. The amount of acid used, the time of digestion, and the temperature employed can be so nicely regulated, that a liquor can be almost completely deodorized, and practically every drop of objectionable fusel oil removed, or enough fusel oil left in the liquor to suit the requirements of the trade or of the individual taste. Prof. Hilgard states that if sulphuric acid should be undesirable, it is possible to employ other polybasic acids, such as phosphoric, tartaric, oxalic, etc.

The amount of sulphuric acid employed in the case of whiskies is almost negligibly minute, for it ranges from one-quarter to two-thirds of one per cent by volume to 100 of proof spirit.

The brooding temperature is usually maintained between 145 and 150 deg. Fahr. for whiskies. The time of digestion ranges from one to three days, this depending upon the amount of acid used. As soon as the desired flavor is obtained, the liquor is passed off through a refrigerating coil, and neutralized with pure lime carbonate or with sal soda in amounts previously determined. The free acids in the liquor, so far as they have been combined into "esters," are also eliminated in the final distillation. The distillate is entirely free from any of the reagents employed. In other words, it is a whisky, wine, or other liquor, such as would be obtained only after years of storage. In many cases it excels in quality the liquors which have thus been stored. The residues remaining in the retort contain valuable by-products.

In Prof. Hilgard's opinion, the improvement is in the main due to the elimination of the fusel oils, but "it is highly probable that the formation of well-flavored esters from them and the original free acids also have their part therein. In this respect the process is exactly parallel to the ordinary process of aging in casks, but there can be no doubt that the partial removal of the free alcohols not only improves the flavor, but also renders the liquor less liable to produce the serious cerebral and nervous disorders which are all known to result from the use of such fusel-laden raw liquors as the potato whisky of Europe or the French absinthe. The large-scale trials made in Kentucky have shown, within a few months, a most pleasantly flavored, soft liquor which, according to the analyses made at the Internal Revenue Office at Washington, contains but a fraction of the obnoxious fusel oils originally contained in the raw distillate."

One of the most praiseworthy features of the process is to be found in the fact that the distillate is quite free from any foreign addition or flavor. In other words, it has withdrawn from the original liquor the objectionable qualities, and has not added to it a new flavor, which serves to disguise the intrinsic rawness of a new liquor.

Almost every product hitherto obtained has contained some flavor foreign to the quality of the liquor, and has for this reason been discarded. At the present time, the most widely-employed expedient for rendering freshly-distilled liquors acceptable to the palate is this objectionable method of adding flavoring compounds to conceal the rawness. Still another method is to dilute, or "blend," the raw liquor with a large proportion of spirits, whose distillation has by the use of rectifiers been carried so far as to approximate pure ethyl alcohol.

This whole subject of the rapid maturing of liquors is peculiarly timely, in view of the fact that the United States government is now endeavoring to define the term "whisky," and to compel the makers of "blended" whiskies to label their product truthfully. The rectifying system is so extensively practised in the United States, that it may be said our whiskies are almost all "blends." The Howden process, if it is ever commercially introduced, will enable the straight-whisky maker to label his product honestly, to place on the market within a few months a liquor which in quality and flavor cannot be produced except by long years of storage, and to remove the odor of mash without disturbing the congeneric flavors.

Preparation and Constituents of Tea.

The preparation of tea for market comprises four processes: wilting, turning and rolling, fermentation, and roasting. In the course of these processes the proportion of tannin in the leaves is greatly diminished, for example, from nearly 23 per cent to 12 per cent. The characteristic aroma of tea is developed gradually in the process of fermentation, during which the ethereal oils or their chief constituents are set free from the glucosides. The freshly plucked leaves contain about ½ per cent of free caffein (thein) and 3 2/3 per cent of combined caffein, but after roasting three-fourths of the caffein of the leaves is in the free state. The increase of free caffein is proportional to the decomposition of tannin, a fact which indicates that the two substances were originally combined together. The oxygen of the air assists in the decomposition of tannin, but atmospheric organisms play no part in the fermentation, which must, therefore, be caused by ferments already present in the leaves. In the "bud" tea made from the youngest leaves, apparently by simple drying, two-thirds of the caffein remains in the combined state. Burmese tea, which is prepared by crude methods, contains the smallest proportion of combined caffein. Green Chinese tea contains less combined caffein than black tea, and also less tannin.

The Current Supplement.

An elaborate article on the North German Lloyd steamer "George Washington" opens the current Supplement, No. 1747. Mr. C. K. Baldwin writes on automatic feeders for handling material in bulk. The relation of the character of coals to the prevention of smoke is considered by D. T. Randall, engineer of the Fuel Engineering Department of the Geological Survey. A thoughtful article is that entitled "The Tyranny of Scientific Dogma." Few animals are more interesting than ants; just how interesting, Prof. K. Escherich sets forth in a popular article entitled "The Ant and Her Ways." Charles E. Monroe contributes an article on the consumption of nitrate of soda in the United States. At the beginning of the twentieth century there was no automobile industry. To-day we see an industry of imposing magnitude. The demands of motor-car construction are proving a wonderful stimulus to the metallurgy of steels, a subject which is considered by Dr. John A. Mathews in a paper entitled "Alloy Steels for Motor-Car Construction."

Correspondence.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the SCIENTIFIC AMERICAN:

Your leading correspondent in the June 12th issue, who attacks the reasoning of a former correspondent who figured that each of us had 1,424 ancestors ten generations ago, is unconsciously amusing. He seems to forget, in saying that the victim of his sophistic sarcasm must be an only child, that more than one person may have the same ancestor, and that each person has more than two ancestors, as set forth in his illustration of the couple who married ten generations ago and now have 1,424 descendants. Those two were not the only ancestors of the present 1,424 descendants, for the marriage of relatives has not been so prevalent. The statement of his victim that each person had two parents, each of whom had two, etc., comes through his attempted refutation unscathed, and gives each of us 1,024 ancestors; the 400 extra ancestors given us gratis by the first philosopher were the result of bad arithmetic, and not of faulty reasoning. The satirist's statement that our eighth great-grandfather probably has 1,424 descendants is perfectly true, but it fails of his intention to disprove the mathematically accurate statement that each of us had 512 eighth great-grandfathers and an equal number of their better halves. He evidently has little in common with the ancient wise men, who he says simply "observed and applied facts," and his advice to his victim to have a "little sober thought" might well be a boomerang. It might be well for him to soberly consider for a minute how many great-grandfathers he had, and then observingly climb higher in his family tree. WILLARD D. EAKIN.

Washington, D. C.

LARGE VS. MODERATE-SIZED BATTLESHIPS.

To the Editor of the SCIENTIFIC AMERICAN:

As you have always been an advocate of large battleships, I was pleased to note that in a late number of your paper you took the ground that there was danger of going too far in the matter of size, and strongly hinted that the United States had already done so in the new ships authorized.

I believe that time will demonstrate that the huge ships now being built for the various navies of the world have already passed the point where size is an advantage. Money is the factor which finally decides the strength of a nation's navy, at least in number and power of ships. This being true, no navy can be stronger than the ability of the nation to build and maintain ships. Let us suppose one nation has a navy composed of six "Dreadnoughts." On the eve of a battle a steam pipe in the engine room of one of these great ships bursts. The damage to the ship is not serious, but it takes time to make repairs, and when the battle begins, the nation which has put all its power into six "Dreadnoughts" is short just one-sixth of its navy. Its opponent having put its money into smaller ships, has twelve for the same money, and meets with the same misfortune, but it is only short one-twelfth of its strength, and is therefore in better condition to meet the enemy.

These little accidents happen, and the best ships afloat meet with similar mishaps daily, and why not consider such things in building ships of war?

Again, I believe the relative power of such ships as the "New Jersey" and the "Dreadnought" will not work out in actual war as it does on paper. The "Dreadnought" offers a better mark than its smaller neighbor, and will receive more hits, and hits count even against the strong armor of ships.

We may be all wrong in our ideas, but it is generally safest not to put too many eggs into one basket, and this truth may apply to the navies of the world.

Manson, Iowa. T. D. LONG.

PIPES IN RAIL INGOTS.

To the Editor of the SCIENTIFIC AMERICAN:

While manager of the Washburn Steel Castings and Coupler Company, I had several difficult casting propositions; to wit, to secure sound castings without blowholes. One of the usual ways to overcome this difficulty is to use a larger riser, or head; and to secure enough molten metal from these heads to take care of the contraction in the cooling casting, is the question to be solved. It is customary to reduce the end or neck of the riser, where it meets the mold, so as to avoid heavy sawing in removing the feeder from the casting. But when this neck is reduced enough to make its removal practical, it is of such a small size that the sand will freeze or cool it and so cut off the necessary supply of molten metal in the riser or feeder. To overcome this difficulty, I designed a clay pot, patterned exactly on the order of a flower pot, but having a hole of sufficient diameter in the bottom for the hot metal to feed through. This pot was set directly on the pattern, and rammed up with the mold with the usual pouring gate. The result was that the hot metal, after filling the mold, passed up through the bottom of the pot until it was filled. In doing this it heated the clay of the bottom of the pot to practically the temperature of the steel. Then, as the casting cooled, the molten metal fed into the casting through this hole, at times drawing almost the entire inside from the riser, and giving an absolutely sound casting, connected to the riser by the neck, which being only two inches in diameter, was readily broken with a heavy sledge. This type of riser can be easily applied to rail-ingot molds by setting on the mold a metal casing, carrying a heavy fireclay pot inside, which not only retains the heat in the head and gives a sound ingot its entire length, but does it in a very cheap and practical way. EDWIN C. WASHBURN.

Minneapolis, Minn.

SIGNALING TO MARS.

To the Editor of the SCIENTIFIC AMERICAN:

The proposition to signal to Mars, made by an astronomer connected with one of our most famous observatories, has received much attention from the daily press and many of those not familiar with astronomy. It seems to the writer that some things have been overlooked which would render the experiment difficult, if not impossible. Since Mars will at opposition be above the horizon of any place only in the night, it will be necessary to provide artificial light for the flashes to him. This in itself will be an enormous undertaking. Yet it can be done.

The atmosphere of the earth is able to absorb 40 per cent of sunlight; so that in a clear air only 60 per cent of the rays of the lamps can pass beyond our atmosphere, and still less in the vapor-laden evening or night air. The effect of the refraction of the air would be to render indistinct the outline of any object, and thus to confuse the lights.

One professor, not of astronomy, happily, suggests black cloth laid in a pattern on a wide plain. It raises a smile. How can black cloth be seen on a plain in the night? As I said, Mars will be above the horizon only in the night at or near opposition. Hence a Martian will look at the dark side of the earth, and see only its blackness. Seeing black cloth under these circumstances would be like seeing a black man chasing a black cat in a dark cellar. Such a suggestion could not have originated with an astronomer.

Prof. Moulton, in his "Astronomy," page 327, says: "When we see Mars the best, the earth is 'new,' with respect to Mars, and invisible from that direction. The newspaper talk of communication between the earth and Mars by any imaginable means is utter foolishness." The language is strong, but seems to some to be justified. WILLIAM C. PECKHAM.

Adelphi College, Brooklyn, N. Y.

To the Editor of the SCIENTIFIC AMERICAN:

I desire to call attention to a statement that appears in your issue of June 5th, in which the writer, referring to a correspondent in your issue of May 15th, says a heliograph man makes the astounding statement that a mirror two inches square will reflect just as much light as a mirror ten feet square. He did not say any such thing. What he did say is, that a mirror that is two inches square will do just as much work as a mirror that is ten inches square, and explains his statement by saying a mirror can only reject the sun's image. A shaving glass or the water in a horsetrack would reflect the sun's image just as well as the water in a large pond or a lake. An artificial horizon, such as astronomers and travelers use to measure the sun's altitude, is not more than six inches in diameter. The mirrors of a sextant are not more than two or three inches in diameter. The mirror of the heliotrope that is used in the U. S. Coast Survey is not more than two inches square. For a description of the heliotrope, the reader is referred to Gore's "Geodesy." There is a difference between reflecting the sun's image and reflecting the image of the side of a house.

Prof. Pickering suggests that a number of large mirrors ten feet square be set up at a cost of $100,000 to make a preliminary experiment to determine the possibility of signaling to Mars. It must be remembered that these mirrors must be mounted like a heliotrope, and provided with very fine adjustments to be of any use, and each one would reflect its own image of the sun independently, and they would not transmit a signal any farther than a single mirror two inches square. The greatest distance that a heliotrope has been known to transmit a signal is 192 miles.

The moon when full reflects her own image to the earth; in like manner Mars reflects his image to the observer here, and appears as a mere point. His apparent diameter is about 10 seconds, and his distance from the earth is about 46,000,000 miles. It is a well-known fact that the stars are not where we see them. If you could project a straight line from the eye to Mars, you would not strike the planet by 10,000 miles. The heliotrope can only be used to transmit signals or messages from one well-defined point to another well-defined point where there is an observer to receive it, as from one station of a survey to another. Now, if you project a signal in a straight line from the observatory at Washington to an observatory in a great city on Mars, using the point where you see Mars as the point of direction, where would your signal or message be when it has traveled a distance from the earth to Mars? There are many other factors to be considered before we go to any expense to erect great mirrors to experiment on sending signals or messages to Mars, but it is not worth while to consider them here. JOHN FORD.

Swedesboro, N. J.

The Flight Exhibition of the Aeronautic Society at Morris Park.

On Saturday, June 26th, weather permitting, the first exhibition of the Aeronautic Society will be held at Morris Park race track on the outskirts of New York city.

The chief feature of the exhibition will be an aeroplane flight by Glenn H. Curtiss for the SCIENTIFIC AMERICAN Trophy. Mr. Curtiss won this trophy for the first time last year, and he hopes to set up a record that will not be surpassed this year by any other aviator contesting for the trophy, since the winner for 1909 will be the aviator making the longest flight. Photographs of Mr. Curtiss in flight appeared in our last issue.

Besides the exhibition flight by Mr. Curtiss, there will be a balloon race and a flight by the society's new dirigible. A hundred New York schoolboys will have a kite-flying contest. Several gliders will be towed around the track behind an automobile, and there will also be a wind wagon race, besides contests and exhibits of model aeroplanes.

Among the new full-sized machines that will be exhibited and that will perhaps attempt flights are two bi-planes and a monoplane. This is the first time people in the vicinity of New York have had an opportunity to witness real flights by an aeroplane. The society's new Curtiss bi-plane has already been tested and made flights at Morris Park.

The Celebration at Dayton, Ohio, in Honor of the Wright Brothers.

Last Thursday and Friday, June 17th and 18th, were devoted by the business men and residents of Dayton, Ohio, to a celebration in honor of Orville and Wilbur Wright. The chief feature of the celebration was a parade illustrating the development of transportation in America. This was headed by an Indian runner, and ended by a Wright aeroplane. So busily engaged were the brothers in putting the finishing touches on their government machine that they could hardly find time to attend the presentation exercises and receive the medals awarded them by Congress and the city of Dayton, as well as the diamond-studded shield voted by the Ohio legislature. The medals and shield were presented by Brigadier-General James Allen, Mayor Edward E. Burkhart, and Governor Judson Harmon, respectively. After thanking the donors Wilbur Wright made a short speech in which he said that although inventors sometimes complain of lack of sympathy and encouragement, he and his brother had not found it so, for at the very beginning of their experiments they had received offers of financial assistance from people who had nothing to gain. In his opinion, if worthy inventors did not get assistance it was because their needs were not known and not because of indifference.

As we go to press the brothers are starting for Washington, where they expect to make the first flights at Fort Myer in fulfillment of their government contract this week.

Where to Find the Scientific American When Traveling.

Those of our readers who may spend part of the summer in travel at home or abroad, will find the SCIENTIFIC AMERICAN on all the principal steamship lines and on most of the limited trains. Thus it is carried on the library cars of fifty trains on the New York Central Railroad, and west of Chicago it will be found on the trains of the Chicago and North-Western, the Burlington Route, the Northern Pacific, and on all the trains and steamers of the Southern Pacific Railroad. The Cunard, White Star, Hamburg-American, and other principal lines carry it regularly in their library saloons. This will prove a great convenience for our regular readers.

A correspondent draws our attention to a novel and daring method of bridge erection, which was successfully carried through by a member of the Jones Construction Company, San Francisco, in the replacing of a 125-foot span of a railroad bridge at Vancouver Island. The new span was built on flat cars, hauled into position on the bridge, and suspended from two gallows frames. The old span was then thrown into the river, 120 feet below, and the new span, weighing 60 tons, lowered into position. This was done without an engine or tackle block, by the simple expedient of slacking away the lines over the top of the gallows frames.

FELLING A WATER TANK.

BY W. H. LAWTON.

The old water tank that has long stood at the brow of the hill in Vermillion, So. Dak., has been razed. Since the installation of the water works, it has been the most prominent landmark of that region. For a distance of several miles it could be seen lifting its great head, a solitary figure, sharp cut against the sky.

It consisted of a tower 100 feet high, holding aloft the enormous tank that held the supply of water which fed the city mains.

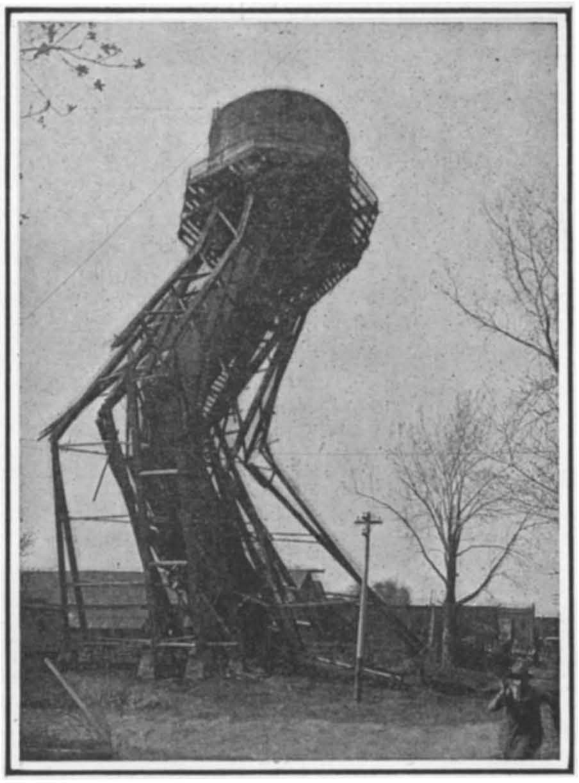
The 6-inch pipe which carried the water from the wells below the hill, was incased in a box of heavy planks. Surrounding this were twelve timbers, each 12 by 12, rising perpendicularly from as many abutments of stone to the tank above.

Outside of these were eight batter posts, each 10 by 12, bracing and strengthening it, connecting near the top with the inner pillars. These timbers were connected by a series of iron rods an inch in diameter at intervals of 10 feet, and, to give still greater stability, a similar rod leading from the center of the tower was securely fastened to a large cottonwood tree near by.

The tank itself was 16 feet high and 20 feet in diameter, with staves 12 inches wide and 3 inches thick surrounded by thirteen 3-inch iron hoops. When it was full the weight was enormous, and more than a year ago it was found to incline slightly from the perpendicular. This inclination increased gradually, for several months, the legs assuming a decided curve, and was plainly a menace to life and property. The city condemned it, and the State fire marshal ordered it down, yet it stayed because no safe method for its destruction could be evolved. Finally, on May 7th, a number of determined citizens met, and resolved in some way to destroy it. The iron rods were cut, and then an attempt was made to destroy the foundation with blasting powder, but without success. Great ropes, with block and tackle attachment, were fastened to the lower ends of the supporting pillars, and the great structure was slowly loosened from its foundation. The work lasted all day, the crowd of onlookers gradually increasing until at least a thousand people saw the final demolition.

The interest was intense; slowly the great timbers lifted, and the curve in the center became more pronounced. Then as the tower suddenly stretched itself in a splintered, broken mass of ruins, the great tank, with its 150 tons of water, separated itself from its support, described an arc of a circle, and precipitated itself, a crushed mass, directly underneath the place where it had stood. The force of the water was terrific. The strong staves were snapped like pipe-stems; portions of the debris were thrown more than a hundred feet, and a 10-pound stone was hurled through a building as far away. A barn near by was completely demolished, and one of the abutments, each of which weighed over a ton, was carried by the giant force a distance of 40 feet. The force of the water dug a hole, 20 feet across and at least 4 feet deep, where it reached the earth.

[With so limited information at our disposal as to the particular nature of the difficulty above described, we do not like to be too critical; but this appears to us to be an excellent illustration of how *not* to do things. A tank 20 feet in diameter and 16 feet high appears to have been full of water when felled from a height of 100 feet, the fall of this great weight having materially added to the local excitement. Whatever the extent of the settlement of the foundation piers or of the curvature of the legs, if that 150 *tons* of water was still supported 100 feet in the air, it is incredible that the tower would not have safely supported the weight of any number of workmen after the water had been withdrawn. The tower and tank must have been built from the bottom upward, and its demolition from the top downward could not have been difficult. The lower portion of the tower with its constantly decreasing load as the upper part was removed must have remained always amply strong to support the workmen and necessary tackle to lower the upper members. One would have supposed that any local contractor would have been glad to undertake the removal of the tower for nothing, and would have made a handsome profit from the materials salved. Instead, the method employed seems to have been the one best adapted for the splintering to matchwood of 15,000 feet of lumber in the form of 12 x 12 alone. If the tower had been burned down, the operation would have been simpler and hardly more wastefully destructive.—Ed.]



THE DESTRUCTION OF THE WATER TANK AT VERMILLION, S. D.

A MOTOR PLOW.

BY DR. ALFRED GRADENWITZ.

The use of machine plows, apart from a saving in human and animal labor, affords the advantage of allowing the soil to be broken up more deeply and effectively, thus insuring far better crops.

The Deutz Gas Motor Works of Deutz, near Cologne, have recently achieved a further progress in this direction by substituting liquid-fuel motors for the steam engine usually employed. Whereas steam plows of the compound-engine system (which is the one most generally in use), in addition to teams for supplying coal and water, require for their operation two mechanics and three plowmen, the motor-driven plow is steered and operated by a single driver, the only additional help being a man for shifting the mooring truck. In fact, the daily fuel and water supply is readily carried on this locomotive. Though its fuel—gasoline—is much more expensive than coal, the total fuel expenses are approximately the same, the motor working under fairly uniform loads and with higher economy.

Furthermore, the new motor is so light and substantial as to be able to travel in front of the plow, and to carry it across the field. Steam plows are carried to and fro by a heavy rope between two heavy steam locomotives. The pull of a locomotive is known to depend on the weight supported by the driving wheels; and by designing all the wheels as driving wheels, a maximum of tractive effort is obviously obtained.

Only in the case of exceptionally deep plowing or on slippery ground will the use of a light rope wound over the pulley drums of the locomotive be found of advantage. This rope, according to a patented arrangement, is left lying on the ground as long as the direct pull of the locomotive suffices for its propulsion, in order to be tightened automatically as soon as there is some slip on the driving wheels. As the full plow-resistance is never to be dealt with, a thin, light, and accordingly flexible and easily-handled rope is found sufficient in contrast to the heavy ropes of steam plows. A light mooring truck acts as a trailer to the plow-motor, and can be used also for carrying along material and tools.

The plow locomotive is connected to two multiple-blade plows arranged in front of and behind the motor respectively. This arrangement dispenses with the troublesome turning of the plow. Both in forward and backward traveling (when the front plow in the direction of traveling should obviously be raised) the same pull is exerted. By adjusting the two pairs of wheels simultaneously in a slanting direction, the plow locomotive is shifted through the useful plowing width.

The motor allows any depth of furrow to be plowed without shifting the mooring truck.

The capacity of the motor plow is 12 to 22 acres during 12 hours, according to the weight of the soil and the depth of furrows. As its weight only amounts to one-fifth of that of a steam plow, it is able to travel on any roads and bridges without requiring any special authorization.

Another Daniel Comet.

J. Z. Daniel, the discoverer of the Daniel comet of 1907, announces the discovery of another comet in the northwest corner of the constellation Pisces. At the time of its discovery, June 16th, the comet was moving at the rate of one and one-half degrees per day, and was visible with a three-inch telescope between 2 and 3 o'clock in the morning. Confirmatory dispatches have been received from Europe.

The Publication of the Prize Fourth Dimension Essay.

The essay of Lieut.-Col. Graham Denby Fitch, which won the $500 prize given by a friend of the Scientific American for the best simple explanation of the term "fourth dimension," will be published in the Scientific American of July 3rd, 1909. The essays which received honorable mention will be published in the Scientific American Supplement of July 10th, 17th, and 24th.

A NEW GASOLINE MOTOR PLOW.

RECENT FRENCH AEROPLANES AND THEIR PERFORMANCES.

Three of the photographs reproduced herewith show three of the latest successful French aeroplanes in flight, while the fourth picture shows one of the new biplanes which has recently been produced in that country.

The most noteworthy of the two monoplanes shown in flight is the "Antoinette IV," which, driven by Mr. Hubert Latham, an Englishman, has recently made some extraordinary flights. After only about fifteen practice flights, Mr. Latham began making record performances. Some of these have been noted by us in previous issues. The most remarkable of all of them is that made on Saturday, June 5th, when he remained in the air in continuous flight for 1 hour, 7 minutes, and 37 seconds, while traveling continuously at a speed of about 45 miles an hour. This flight beats all French records (with the exception of Wilbur Wright's

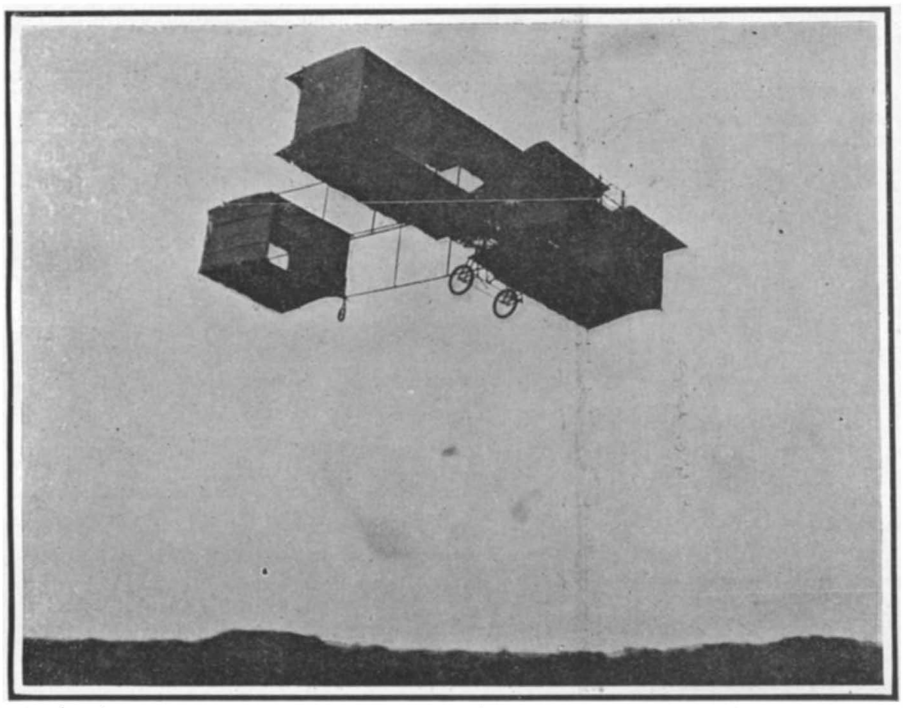
(*Concluded on page 487.*)

THE CONSTRUCTION OF THE ZEPPELIN AIRSHIP.

The illustration which appears below will give the reader an excellent idea of the general construction of the latest Zeppelin airship "Zeppelin II"—which recently made a record flight of about 900 miles, as described in our last two issues.

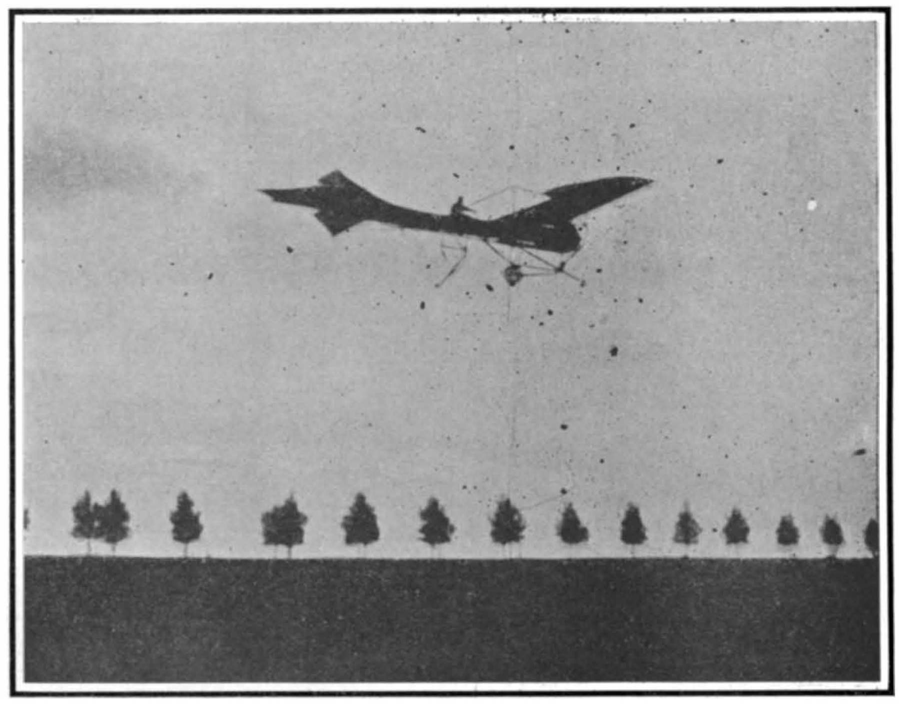
The airship consists of a trussed aluminium frame having tapered ends, and which is divided by vertical partitions into 17 compartments. Each of these com-

(*Continued on page 487.*)



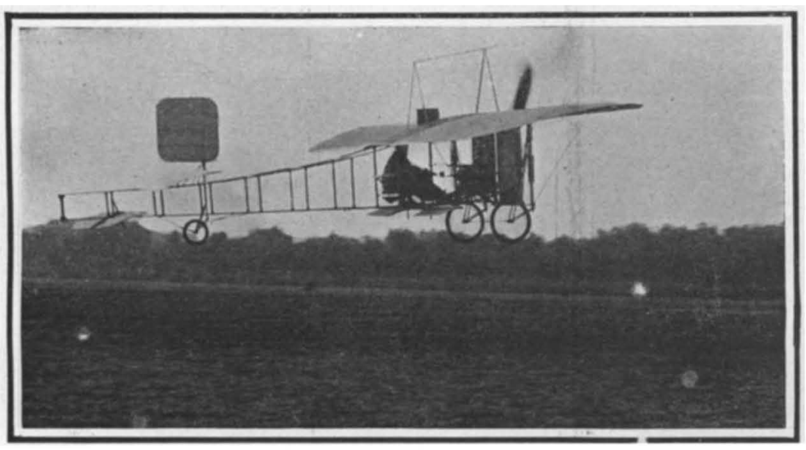
M. De Rue's Voisin biplane winning the Archdeacon cup.

De Rue flew about 6 miles in a 15-mile wind June 6th at Port Aviation, Juvissy.



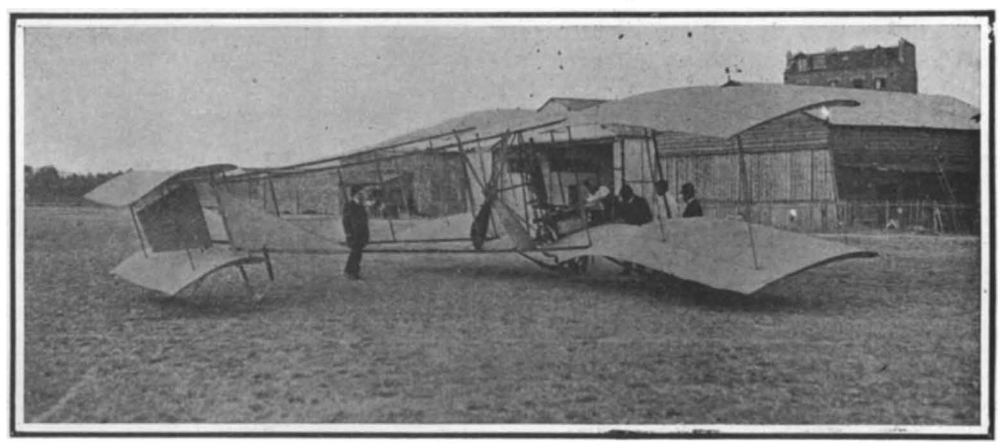
Latham making his 1 hour 7 minute record flight with the "Antoinette IV."

This is one of the most successful French aeroplanes. It has a 50-horse-power 8-cylinder motor.



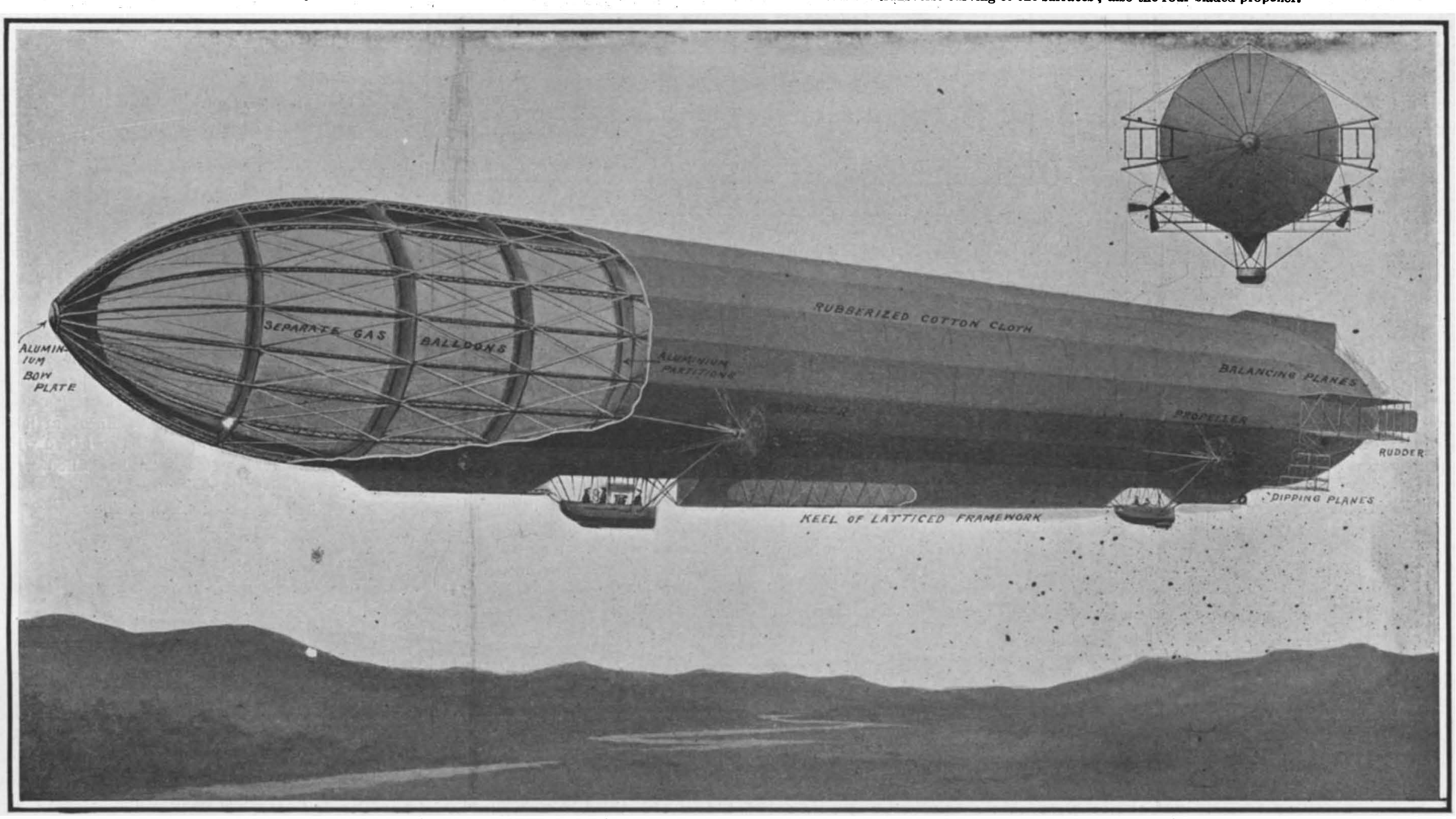
M. Louis Bleriot flying in his No. 12 monoplane.

Note the two horizontal rudders below the body and the vertical rudder and fixed surface above.



The Lepetil aeroplane—a new biplane resembling the Voisin in general outline.

Note the transverse curving of the surfaces; also the four-bladed propeller.



View of the Zeppelin airship, showing compartment construction and arrangement of the various parts.

A 110-horse-power motor in each car drives a propeller on each side of the airship. Triple vertical rudders are placed between the stabilizing planes at the rear and multiple horizontal rudders are located both fore and aft.

THE LATEST FRENCH AND GERMAN AEROPLANES AND AIRSHIPS.

A MACHINE THAT SETS ORDINARY TYPE.

BY M. M. HUNTING.

Nearly everyone is more or less familiar with the type-setting machines that are in daily use in our large newspaper and printing offices, which cast the type from molten metal as the machine is operated. To build a machine which would set ready-made type has been the ambition of a number of inventors for some years past. The most recent solution of the problem is embodied in a machine invented by Mr. A. G. Baker, of Albion, Mich.

The machine has a capacity of setting ten lines of type per minute of ordinary column width, or technically speaking, ten thousand ems an hour, as against a record of six to seven thousand ems on the older machines.

The upright portion of the machine is called the magazine, and consists of ninety channels containing the different letters of the alphabet, punctuation marks, and other characters used in printing. Each channel is just wide enough to contain the character allotted to it without allowing it any more room than it requires to slide up and down easily. The channels are entirely independent of one another, so that any of them can be removed from the machine if desired without disturbing the others.

The first channel at the right is but eight inches long, while each succeeding one is one-eighth of an inch longer, so that the lower end of the magazine is inclined from right to left, the top being level.

The type is set by pressing the keys on the keyboard, as in other type-setting machines. When a key is pressed, it operates a plunger, which enters its corresponding channel from the rear, and pushes the lower piece of type out into the inclined guide plate in front, whence it is carried by gravity to the assembling point at the lower left-hand corner of the machine. The guide plate is so tilted that those characters which are farthest from the assembling point will travel fastest when released from the magazine, because of the greater inclination of the plate at that end, while those nearer travel more slowly. Consequently, all arrive at the assembling point at the same time. This enables one to operate the machine very rapidly without the danger of transposing letters.

As the letters reach the angle in the guide plate at the lower left-hand corner, a sort of escapement action, actuated by a spring concealed in the base, and operated by the depression of the keys, places them on their feet in line ready for removal at such time as may be desired.

One of the machine's most ingenious features is the distributing mechanism, which operates backward and forward across the top of the magazine, similar in action to the carriage of a typewriter. This part of the machine contains a number of channels, like those of the magazine, except that they are much shorter. In each channel of the distributer a line of type is placed, and as the keys are pressed in the setting of a new form, the distributing device moves backward and forward one space at a time. At the top of each channel of the magazine, and extending about one-third of the way across the opening, are steel strips called "wards." Each ward has a number of protuberances upon its surface, corresponding in number and shape to the nicks on the side of each type character. The ward and its corresponding type character will fit each other perfectly, but neither will fit any other except its own counterpart. As the distributer moves across the top of the magazine, each piece of type is tested against the wards until it finds its corresponding ward, and falls into its own channel. In this way the type is distributed without any extra effort on the part of the operator, and coincident with the setting of a new form.

The machine has been designed to set all standard sizes and styles of type. Type having the same sized body, no matter what variation there may be in the face, may be used in the same machine indiscriminately; but where there is a difference in the size of the body, adjustments have to be made in the machine to accommodate the change.

The fact that the machine requires no power for its operation, and no gas or other heat for melting metal, adapts it particularly well for the use of country newspapers, that have been unable heretofore to make use of the advantages offered by such machinery, owing to the lack of proper facilities.

The machine is most advantageously operated by two men, one setting the type and the other spacing the lines or justifying them, as it is commonly called.

All corrections in the proof are made from the ordinary case of type, as this requires less time than making the changes with the machine.

A MACHINE THAT SETS ORDINARY TYPE.

A New Technical School for Women.

Teachers' College, Columbia University, will open in September a studio and laboratory building costing over half a million dollars and devoted to its new School of Household Arts. This equipment, comprising a six-story building, 160 x 60 feet, fully furnished for its purpose, is dedicated solely to instruction in the arts and sciences upon which rational household living depends. One floor devoted to foods and cookery, another to textiles and needlework, another to the application of chemical and biological sciences in matters of household concern, studios for instruction in the artistic aspects of the house and its decoration, laboratories for instruction in the management of laundries as they exist in institutions, a model apartment for teaching purposes—these details of equipment give some idea of the comprehensive plans for the school.

The courses of instruction provide preparation for the teachers of the household arts in schools and colleges, and as well technical instruction for women who wish to manage domestic households or to become administrators of larger institutional households, as college dormitories, asylums, and hospitals. There are also comprehensive certificate courses for the dietician, or woman responsible for the commissary department of such institutions, and in interior decorations, a promising profession for women of artistic gifts. Other courses provide training in dressmaking and millinery, cookery, the care of infants and small children, costume design, house planning, and in other specific practical fields. It is in these technical divisions that woman's education promises a most significant development in the next few years.

Chemical Disinfectants.

A German investigator finds that the humic acid of acid soils checks the growth of bacteria. This result was obtained by comparing the effects of fresh peat mold and peat which had been freed of acid by leaching. The soil of moors produced similar results. The bactericidal properties of the metallic salts sodium chloride, calcium chloride, and copper sulphate, and the carbon compounds ether, benzine, carbon tetrachloride, and toluol were also studied. Sodium chloride added to urine in the proportion of 2 per cent had no effect on the bacteria, but their growth was arrested by ⅛ per cent of copper sulphate and by a mere trace of calcium chloride, while ¼ per cent of calcium chloride produced complete sterilization. Of the carbon compounds tested toluol alone exhibited antiseptic properties, while ether stimulated the growth of bacteria. The effect of metallic salts and peat mold in conjunction was also investigated. The addition of peat mold to a soil containing sodium chloride diminished the growth of bacteria. The germicidal action of calcium chloride is accelerated by the addition of peat mold, because the humic acid combines with the calcium and the chlorine is set free.

Soap and Other Detergents of Antiquity.

BY O. BECHSTEIN.

The Greeks, Romans, Egyptians, Babylonians, and other ancient nations of high culture form only apparent exceptions to the rule that the civilization of a people is proportional to its consumption of soap, for, although these nations used little soap in the strict sense of the word, they employed several other substances of similar properties.

Two of these cleansing agents are mentioned in the Bible: "borith" in Jeremiah ii, 22, and Malachi iii, 2, and "nether" in the same passage of Jeremiah and in several of the Proverbs of Solomon. In the English Bible these Hebrew words are translated by "soap" and "niter."

Borith was an alkali obtained from the ashes of plants, in other words, crude potash. The nether of the Bible was probably the native sodium carbonate, or natron, the nitrum of the Romans, which is found in Egypt, around the Caspian Sea, and in other desert regions and which is still collected for laundry use in Egypt. "Alkali," the Arabian equivalent of nether, appears also to have been impure soda for, although it was obtained from the ashes of a plant, this plant was probably the samphire or saltwort (*Salicornia*) which, like many other seashore plants, contains soda but not potash.

The ancients also used as a cleansing agent the mucilaginous sap of certain plants, probably species of soapwort (*Saponaria*).

Another ancient detergent was putrid urine, which owes its cleansing properties to the ammonia which it contains. At the commencement of the Christian era the Roman laundrymen (*fullones*) possessed the privilege of maintaining public urinals in the streets, and, two centuries later, their business was so lucrative that it was subjected to a special tax. In Roman laundries the garments were first washed with lye and then laid in shallow earthen vessels, sprinkled with urine and trodden with the feet. They were afterward rinsed in water and exposed to the air to remove the odor of urine. The laundries were so offensive that they were placed outside of the city or in outlying quarters. Putrid urine is still used in washing in many parts of the world.

Soap made by combining grease and alkali appears to have been first mentioned by Pliny in the first century. It is described, not as a detergent, but as a pomade employed by the Gauls to give the hair a fine gloss and a reddish tint. Both hard and soft soap were made from goat's fat and beech ashes. The soap must also have contained coloring matter, but this is not mentioned. The Romans adopted from the Gauls the use of soap, and employed it extensively on the hair. Pliny says that the Gauls invented soap, but it is more probable that they adopted it from the Germans, who, in turn, may have obtained the knowledge of it from the Levant.

The use of soap in washing is first mentioned, in the second century, by Galen, who adds, however, that the Romans used various earths in washing the face. Probably soap remained an article of luxury, employed as a cosmetic and occasionally as a medicine, during the second and third centuries, while the older cleansing agents were generally used in the laundry and toilet. It is even doubtful whether the *saponarii* of the fourth century were soapmakers, or manufacturers of cosmetics in general. In Germany the use of soap has been traced back to the reign of Charlemagne, about 800 A. D., but soapmaking was at first a household art, not a trade. Until later in the Middle Ages soap was used only for washing the person and the finest articles of clothing, while ordinary garments were washed with lye made by pouring hot water on a bag filled with wood ashes.—Translated from Prometheus.

The Legal Status of the Snail in France.

The French Minister of Agriculture, after a careful examination of the subject, has established "the legal status of the snail" by issuing a circular in which snails are defined as animals injurious to vegetation, and therefore legally subject to capture and destruction at all times and seasons. This decision has created excitement and dismay among the numerous persons who earn a livelihood by collecting snails for market. Snails are in high favor with French epicures, and immense numbers of these mollusks are eaten in Paris. In the winter of 1900 the consumption of snails in the French capital amounted to 800 tons. The consumption has since diminished, but more than 80 million snails are still received annually by the Halles Centrales, the great market of Paris.

HOW TO MAKE CONCRETE POTTERY.—II.

BY RALPH C. DAVISON.

(*Continued from the issue of June 12th, 1909.*)

The next step is the covering of the forms with the cement mortar. The first operation is the application of a roughing or scratch coat. The mortar for the

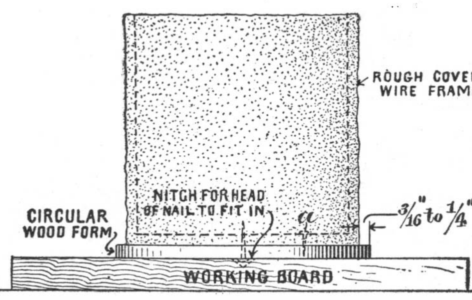


Fig. 4.—METHOD OF ATTACHING ROUGH-COATED JAR TO CIRCULAR WOOD FORM.

scratch coat should be made of one part Portland cement and two parts of fairly fine, clean sand. This is known as a 1-to-2 mixture. The cement and sand should be thoroughly mixed together while dry; and to this mixture before wetting should be added enough plasterer's hair to bind the particles together. Goat's hair is the best to use. It can be procured at almost any plasterer's or mason supply dealer's. It comes in matted bunches, which should be picked apart and the hair separated before adding to the cement and sand. The whole should then be wet down with water and thoroughly mixed. Be careful not to get the mixture too wet, for if so it will not hang to the forms. The proper consistency is that of a stiff paste. Probably the best tool to apply this mortar to small work is an ordinary table knife; for large work a regular mason's trowel or float may be used. Take as much of the mortar as can conveniently be handled on the end of the knife, and commencing at the bottom of the sides of the frame, force the mortar well in between the meshes of the form. Continue this operation until the entire sides of the frame are covered. Then turn the frame bottom side up, and cover the bottom in like manner. The rougher the surface, the better. Do not do anything to the inside of the frame as yet. After having completely covered the frame as described above, let the mortar set or harden, so that it will be securely cemented to the wire frame. In about four or five hours the mortar will have hardened sufficiently, so that the form can again be handled with safety.

The finishing coat can then be applied. The mortar for the finishing coat can be made of a number of different ingredients, all of which will produce a different result as far as texture and color are concerned. The method of applying the finish coat, however, is the same in all cases. Therefore to start with, we will make the mortar to be used for the finish coat of the following mixture: 1 part of Portland cement and 2 parts of marble dust. This mixture will produce a fairly light surface when dried out, and one which is full of sparkle. It should be mixed to the consistency of a heavy paste as before. The method of applying the

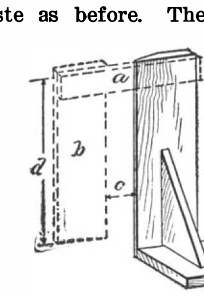


Fig. 5.—FORMER OR TEMPLATE FOR TRUING OUTSIDE OF JAR.

finish coat and forming the jar to the desired shape is as follows:

First cut a piece of wood, say ½ inch thick, into a circle having a diameter about ⅜ or ½ inch larger than the greatest diameter of the rough coat, which is already placed in the wire form. Now with a pair of dividers find the approximate center of the bottom of the rough-surfaced concrete frame, and put a small hole through the mortar at this point as well as at another point near the circumference. Take the circular piece of wood and drive a nail through its center, and in turn place this nail in the hole already made in the center of the bottom of the rough-covered form. Now turn the jar over, letting it rest on the circular piece of wood, as shown in Fig. 4, and you will note that the wood projects from 3/16 to ¼ of an inch all around the rough coat. The finish coat must be built out as far as this. Before going further drive a nail or tack lightly into the wood through the hole which was made in the bottom of the jar near its circumference, as indicated at *a*, Fig. 1. This will hold the jar to the circular wood form, so that it will turn with it. As shown in the illustration, the head of the nail in the center of the circular piece of wood should project beyond the bottom, and a niche should be cut in the working board for it to fit in. The head of the nail will then act as an axis around which the wood and jar can be revolved.

The next step is to make a template or forming strip for the outside of the jar. In this case the jar has perfectly straight sides, therefore all that is necessary is a straight piece of wood. It should be made one inch or more longer than the distance from the working board to the top of the finished jar, and should be mounted on a frame, as shown in the illustration, Fig. 5, so that it will be perpendicular at all times. The cutting edge of the forming strip should be beveled off as shown. After making this, all of the tools necessary for the forming of the jar are complete, and the putting on of the finishing coat can be commenced.

This is done as follows: First rough up and scratch with a sharp tool, such as the teeth of a saw blade, the rough-coated jar, and then thoroughly wash off with a brush and water any loose particles of cement that may be present. Then, as was done in placing the roughing coat, take as much of the already prepared finishing coat as can be held on the end of a knife blade, and commencing at the bottom of the jar build out to the edge of the circular piece of wood which acts as a guide for the forming template.

Cover the whole surface with the finishing coat, gradually building it out to the required thickness. Now hold the template firmly against the circular guide, and at the same time revolve the jar. By so doing, all surplus cement will be cut or scraped off by the edge of the upright template, thus giving a perfect-

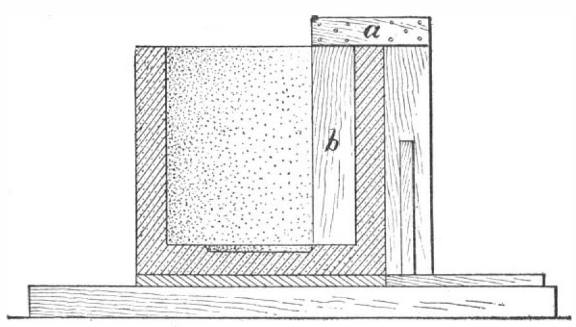


Fig. 6.—THE FORMER ARRANGED FOR TRUING THE INNER FACE OF THE SIDE WALL.

ly smooth and true surface to the jar. After this operation it will be found that the top of the sides of the jar are left in rather a crude, rough state. To even these up and to obtain a uniform height, nail a piece of wood, as indicated by the dotted lines at *a* in Fig. 5, to the upright template, and at the proper elevation to scrape the top of the sides to the desired level.

Again place the template in position against the edge of the circular wood guide at the bottom of the jar, and start revolving the piece. The projecting piece of wood *a*, which has been attached to the upright template, will strike the high spots and cut them off. Thin down with water the mortar used for the finishing coat until it is a little more of a paste than was used for the sides, and fill in the low spots on top of the jar. Keep revolving the jar and adding mortar until a perfectly smooth, even surface is obtained.

In finishing the inside, the rough surface should be scratched and washed as was the outside surface before starting to lay on the finish coat. Having the outside surface as a guide, it is an easy matter to true up the inside without any further tools than a thin straight edge or a long table knife. But if one feels that he cannot make a true enough surface, another strip of wood, as shown at *b*, Fig. 5, can be attached to piece *a*, which has already been secured to the upright template, in which case the distance *c* should be the same as the desired thickness of the finished walls of the jar, and the distance *d* should be the same as the desired inside depth. Then by placing the template or forming tool as shown in Fig. 6 and revolving the jar, a true surface will be obtained. It will be found that the lower end of the strip *b* while revolving in the jar has formed a ring at the bottom of the jar, from the surplus cement mortar which has fallen from the sides. This ring acts as an excellent guide for truing up the inner surface of the bottom. If there is not enough surplus cement in the bottom of the jar to true up the center portion of it, add a little more and tamp or tap it down until it appears about even with the ring around the sides. Then take a piece of wood with a straight edge and a trifle smaller than the inside of the jar. Let this rest on the ring at the bottom, as indicated in Fig. 7. Hold the template stationary, and revolve the jar. With a little coaxing and by filling up the low spots as they appear, with a thin mortar, a perfectly smooth surface will be obtained. Having completed the inner face of the bottom, turn the jar over and let it rest on its top. Remove the round wood guide which is secured to the bottom by nails, and then scratch the cement surface which is now exposed and wet it down. Now add or lay on the finishing coat, and true it off by means of the same template and former as was used for finishing the top edge, only adjust the strip *a* so that it will allow of the desired thickness of finish to be given to the bottom of the jar.

Now, as far as the finish and form of the jar are concerned, it is complete. Having gone through the operations necessary for the completion of a round jar, it will be easy to build up a square or oblong piece, as the operation is practically the same, the only difference being in the forming and finishing. Here

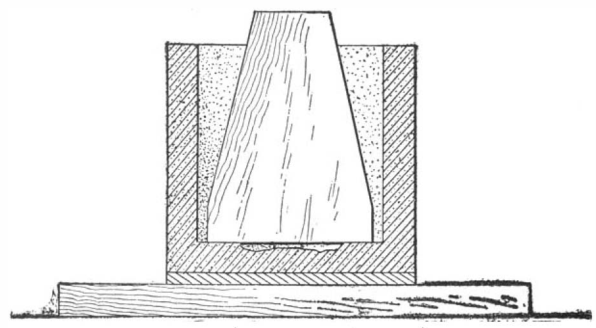


Fig. 7.—TRUING THE INNER FACE OF THE BOTTOM WALL.

instead of using a round wood guide or form and revolving the piece, a square or oblong guide, as the case may be, is used and the template or former is held against it and moved along, thus cutting off the surplus cement mortar and giving a smooth surface to the sides.

(*To be continued.*)

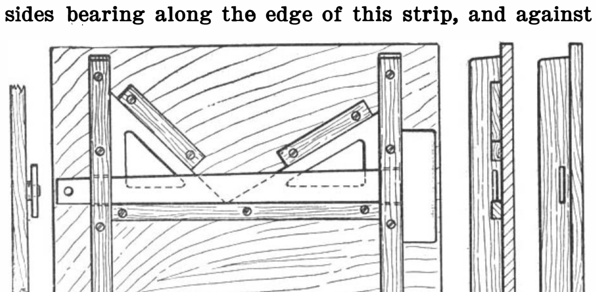
A CONVENIENT CARRYING ARRANGEMENT FOR A DRAWING OUTFIT.

BY I. G. BAYLEY.

The various instruction classes in drawing held at night schools, Young Men's Christian Associations, or institutes, necessitates some convenient manner to carry the drawing utensils used by those who attend. The general practice is to wrap them in a black cloth or large bag made of the same material, either of which is altogether unsatisfactory, the trouble generally being with the T square. To obviate this, the following arrangement was adopted by a student, which was voted a marked improvement over the others:

The illustration shows the under side of the board with T square and triangles secured in place for carrying. A narrow slot, shown in the end view, large enough for the T square to pass conveniently through, is cut in each batten. The slots can either be in the center of the batten or nearer one edge of the board, according to the location of the screws which hold the battens to the board; that is, supposing the carrying arrangement is being adapted to a drawing board already made. The slots must be high enough from the surface of the board to permit the triangles to pass between the blade of the T square and the board. A narrow strip of wood, deep enough to be flush with the surface of the T square when the latter is in place, is secured to the board with nails or screws. It should bear along the edge of the T square, so that the latter will not wear on the end walls of the slots in the battens, thus preserving the edge.

The triangles are put in position, the right-angle sides bearing along the edge of this strip, and against



HOW TO SECURE THE T SQUARE AND TRIANGLES TO A DRAWING BOARD.

the battens, when the short strips shown are placed along the hypotenuse edge of the triangles and secured to the board. To keep the T square in place, a round peg, having a shouldered end of the same diameter as the hole in the square, is secured to the board in convenient position with a fine long screw.

The cross-section view, taken through the center of the board. shows the strips of wood in relation to the slot in the battens.

The triangles are put in position first, when the T square is slipped over them, through the slots, the end being lifted and sprung over the shouldered peg, which should be nicely smoothed over for this purpose. The whole can be carried as it is with perfect safety, or wrapped in a convenient cloth for cleanliness.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

NECKTIE-DISPLAY STAND. — W. A. Swann, New York, N. Y. On this stand a partly tied or folded necktie may be supported so as to enable a customer to see how the tie would look when completely tied. The necktie may be supported in the holder without completely tying the same, and even if left in the holder a considerable length of time, it will not become permanently creased or wrinkled so as to destroy its market value.

Electrical Devices.

ELECTROLIER-SWITCH. — C. Tomschik, New York, N. Y. The invention refers to electric switches such as used on chandeliers or electroliers for turning on the lights. The object is to produce a switch readily operated by a chain or similar means so as to have a step-by-step advancing movement, each position of the switch corresponding to a certain number of lighted lamps.

SEMAPHORE-CONTROLLER.—T. F. McAndrews and J. E. Bleibtrey, Waterford, N. Y. Among the important objects of this invention may be enumerated the grant of sufficient time for the motor to acquire a momentum before it takes on the full load, the increase of the speed of the rod in respect to the operating lever therefor, and the automatic control of the motor.

Of Interest to Farmers.

HEATER.—F. Buehring, Grand Junction, Colo. The aim of the inventor is to provide a device which can be easily carried about from place to place for heating the air around fruit trees or the like, thus obviating the danger of the latter being injured by frost; or can be used for creating a "smudge" as a protection against the rays of the sun.

SIEVE-HANGER.—A. P. Troxell, Breckenridge, Ill. The improvement pertains to grain separators, and the object is to provide a new sieve hanger or adjuster, arranged to permit quick changing of the motion of the sieves, to allow the threshed material to pass slower or quicker over the sieves with a view to insure thorough cleaning of the materials.

CULTIVATOR.—A. C. Lodwig and O. Naumann, Oxnard, Cal. One purpose here is to afford the machine perfect control of the shovel blades, so that they may be adjusted laterally toward or from a row of plants and be raised from the ground and lowered into engagement therewith, and at the time the blades are shifted laterally, so guide the wheels that they will be caused to speedily travel in a track that corresponds with the lateral adjustment given to the shovel blades.

Of General Interest.

DISPLAY-STAND.—J. Gullong, Holyoke, Mass. The improvement has in view a revoluble body having vertical peripheral strips or other equivalent means on which are adjustably secured radially-arranged channeled holders adapted to engage the articles on display on the top and bottom edges, and holders arranged at approximately right-angles to a diameter of the body and attached to the strips intermediate the radial holders, adapted to likewise engage such an article. Means provide for inserting and removing articles such as books and papers from the holder.

EYEGLASSES.—J. Friedlander, New York, N. Y. The invention relates to means for mounting the clips which hold the glasses in position on the nose, and more especially with eyeglasses which comprise levers attached to a fixed bow or bar. The object is to provide a construction in which the point of connection between the clips and the lever is substantially concealed behind the post.

PIPE-COUPLING. — G. W. Millar, St. Louis, Mo. The invention is particularly useful in connection with lead pipes to join the ends thereof without the use of a pipe or other joint. An object is to provide a connection by means of which the ends of the two lead pipes can be easily and quickly joined, and which is inexpensive to manufacture.

DEVELOPING-TANK. — J. G. Lavender, New York, N. Y. The object of this inventor is to produce a tank which will greatly facilitate the developing of the plates, especially in respect to the manner in which they are held in position in the tank, and a construction which will facilitate the pouring of the developing fluid into the tank and at the same time enable the light to be excluded.

VALVE.—G. H. Benton, Metuchen, N. J. The invention refers to globe valves, and its object is to provide a valve, arranged to permit convenient and quick renewal of the valve disk without discarding the other parts, to allow regrinding in a simple and effective manner and to permit the packing from coming out of the stuffing box.

PRINTING-FRAME.—C. Dow, New York, N. Y. The invention relates to frames, such as are used by photographers in making prints from plates or negatives. An object is to produce a frame having an improved construction which will greatly facilitate the operation of removing the back of the frame when the exposure of the print is finished.

FIRE-ESCAPE.—E. Miller, Mount Sterling, Ill. In substance the invention consists of a frame in which a drum is mounted to rotate, there being a gear wheel secured to the drum, which meshes with a gear wheel secured to a shaft journaled in the frame, there being governor members secured to the shaft. A cable is wound on the drum, and a spring is secured to the drum to press the cable into place when being wound on the drum. A crank is also provided to rotate the drum to wind the cable.

RECEPTACLE.—O. J. Weeks, New York, N. Y. The invention relates to a receptacle for ice-cream and the like, fashioned from paper, card-board, or other similar material and formed from blanks folded and glued, cemented, or otherwise secured together, so that at the edges or seams the walls are of double thickness, and so that at weak points the receptacle has reinforcing flaps, tabs, or extensions.

HORSESHOE.—M. T. Keenan, New York, N. Y. The invention here is to produce a shoe which is provided with a cushion or resilient tread which normally projects below the lower edge of the body of the shoe so as to cushion the impact of the foot upon the ground, and further, to provide a construction which will enable the cushion to be readily removed and replaced when worn.

BOX.—G. E. Hosch, New York, N. Y. The more particular purpose of this case is to produce a box which is automatically locked when a bottle or other article is placed in it, so as to maintain the article thus deposited inaccessible to persons not authorized to open it, the box being automatically held open—that is, locked in its open position—when the lid is raised to a predetermined position and the box is empty.

POSTING-POST.—F. H. Crump, Los Angeles, Cal. In this patent the intention of the inventor is to provide a device for interposition in a binder bolt, to permit the obtaining of a perfectly flat surface for posting, the insertion or removal of a sheet at pleasure, and the extending of the posting posts to any desired height to fit any binder.

Hardware.

WRENCH.—J. G. Paterson, Los Angeles, Cal. An object of the invention is to provide a wedge adjustment for taking up the lost motion between a nut and the jaws of the wrench, thereby precluding the possibility of the jaws slipping upon the nut so as to round the corners between the faces of the nut.

PLUG-COCK.—J. G. Paterson, Los Angeles, Cal. The invention has in view means to withdraw the plug from its seat in opening the cock, thus avoiding friction and consequent cutting and abrasion of the plug and its seat. When the cock is closed, the plug is forced to its seat tighter than would otherwise be practical in the conventional plug cock.

BUTT-HOOK.—E. W. Smith, Myrtle, Ore. One object of the inventor is to provide a device in which there is no possibility of the hook being disengaged from the eye. To this end he provides a locking member on the hook which locks the eye so that it cannot be withdrawn or disengaged from the hook itself unless the locking member is moved. At the same time the locking member can be easily adjusted to permit the withdrawal of the cable.

SCREW.—O. Rehse, Germantown, Cal. The invention refers to screws which have the threads discontinuous, so that cutting faces are provided transversely of the threads, which serve to bore or drill an opening for the screw, and at the same time to tap or thread the opening. The screw can be operated without difficulty, and obviates the danger of splitting the wood.

CHECKREIN-HOLDER.—R. E. King, Port Norfolk, Va. One of the purposes of this invention is to provide a device in which the checking and unchecking may be done from the seat of the vehicle, and it is accomplished through the medium of a movable roller, which is manipulated by means of the ordinary driving rein.

WRENCH.—L. R. Blackmore, Arlington, N. J. The wrench frame is fitted on the end of the wrench bar, and is arranged at its upper end below the head end of the bar, the latter thus having an extension below the wrench frame. The jaw is carried and movable on such extension of the bar, and has means to bear on the frame and bar. The jaw has side plates along opposite sides of the extension of the bar so they may bear at their lower edges against the upper edge of the wrench frame, the jaw sliding transversely across the head end of the bar.

COMBINED CUSPIDOR AND RUBBISH-RECEPTACLE.—N. A. Pennoyer, Kenosha, Wis. The aim of the invention is to provide details of construction for a combined cuspidor and rubbish receptacle, which enables the sanitary collection of sputum and rubbish separately, in public buildings, railway cars, or in public toilet-rooms, where doors or partitions of such places may be utilized for supporting the improvement conveniently accessible for general use.

Heating and Lighting.

GRATE.—R. D. Granger, New York, N. Y. In accordance with his invention Mr. Granger constructs the cradle with longitudinal angular ribs at opposite sides, the ribs being elevated above the top of the cradle, with one of the ribs arranged normal to the plane of the cradle and the other inclining with respect thereto, and the side flanges of the grate-bars slotted closely adjacent to the ends to receive and fit the ribs.

GUARD FOR LAMP-BULBS.—G. L. Brisbin, Buffalo, N. Y. An object here is to produce a light framework which can be readily constructed and applied without making attachments to the metal parts of the lamp. A further object is to shape the parts in such a way as to prevent the casting of a shadow when the light passes from the end of the bulb, in other words, in ceiling lights.

Household Utilities.

FLY-PAPER HOLDER.—R. E. Fee, Marion, Ind. The purpose in this instance is to provide a holder constructed in two sections slidably connected together, with jaws for clamping the edge of the paper pivoted to the sections, and means normally tending to separate the sections, whereby the paper will be held under tension. The invention is an improvement on a former patent granted to Mr. Fee.

FOLDING TABLE.—M. A. Drees, Peshtigo, Wis. The invention pertains to a table wherein the legs or supports are folded inwardly upon the folding of the table and it has particular reference to a table wherein the legs are linked together in such a manner that the operation of folding automatically brings the supports into a compact position, embraced by the leaves of the table.

BALL-COCK.—A. C. Gordon, Glens Falls, N. Y. The improved device is for use for flush tanks, and the object of the inventor is to provide a device requiring no packing, easily installed, and difficult to become deranged or disordered, and which will further fill the tank quickly without splashing, and operate to instantly cut off and turn on the water without vibration or noise.

DRIER.—D'Arcy B. Plunkett, New York, N. Y. More particularly the invention refers to driers in which the rack serves to support the articles to be dried and is movable into or out of a closed, heated chamber. The object is to so construct the drier that the tubes may be kept cool and serve for ventilating the interior of the chamber, but at the same time the front end of the tubes will be covered so that they cannot be seen, and dust and foreign bodies cannot readily clog therein.

Machines and Mechanical Devices.

VALVE.—W. E. Werd, Roundup, Mont. In this case the valve is of use in dispensing beverages, or as a means for controlling the supply of water for irrigation purposes. The object is to provide an organization which is simple and durable in construction, readily controlled, and one which automatically prevents leakage.

PRINTING-MACHINE.—R. G. Prendes, Habana, Cuba. An object of the invention is to provide a machine which has an endless belt to which the characters are secured, means being provided to ink said characters, and means being provided to move the belt in either direction by a step-by-step movement, and also to move the belt rapidly so that a number of characters will pass the opening in the casing quickly in succession.

PRESSURE-REDUCING VALVE.—F. Nicola, New York, N. Y. The invention pertains to valves adapted for reducing the pressure of a motive agent as it is utilized for useful effect, and more particularly to reduce the pressure of water flowing from high-pressure service conduits, to hose or the like for extinguishing fires or for other purposes that require a controlled uniform pressure of fluid or liquid where used.

WOVEN PILE FABRIC.—W. A. Minifie, Little Falls, N. J. The object here is to provide a woven pile fabric in which pile tufts are securely held in place and a body weave is provided to insure long life of the fabric when in use. To attain this, use is made of a stuffer chain, upper and lower filling shots, pile tufts held on the upper filling shots and pairs of binding threads for the filling shots, the binding threads in each pair passing simultaneously around one set of filling shots and singly around the other filling shots.

WATER-MOTOR.—W. J. White, Oyster Bay, N. Y. An object of the invention is to provide a construction in which the lever arm of a float operating upon a sweep will be constant so that the velocity of the sweep will be substantially uniform. Further, to provide means for counterweighting the sweep when in a horizontal or in an inclined position, and which will relieve the sweep of the counterweight when the sweep is in a substantially vertical position.

BOOK-SEWING MACHINE.—C. J. Rich, Norwood, Mass. The object here is to provide means for looping the tape intermediate the last signature of one book and the first signature of the next succeeding book, so that after the signatures are all sewed and the books separated, there will remain a free end of tape at each side of each book, which may be used in attaching the body of the book to the cover or to the binding.

DESICCATING APPARATUS.—O. Paucksch, Berlin, Germany. The invention relates to improvements in machines for drying potatoes, cereals, and all other materials of the kind and in particular to that class of machines which are provided with a box, casing, or the like underneath two heated drums, said box having the object to prevent the steam evolved by the action of the hot drums on the moist material passed between them from escaping, and to draw off this steam, so that it will not come into contact with the dried material.

COUPON-SAFE.—C. F. Jones, New York, N. Y. The invention refers to safes, the more particular purpose being the provision of a safe containing a supply of coupons connected together in the form of a strip, and further containing means controllable by the entrance of coins for feeding out the coupons.

LOOM.—W. J. Garlick, Paterson, N J. The purpose in this instance is to provide a loom having a plurality of shuttles carrying different colored threads, and arranged to permit moving any one of the shuttles into active position and working it for one or any desired number of picks according to a predetermined design.

DRAFT MECHANISM.—C. E. Estabrook, Springport, Ind. The object of the inventor is to produce a mechanism which will enable several horses or other draft animals to be hitched in such a way that the work will be equally distributed among them. In other words, the lever arm from the point of application of the pulling force, will be adjustable to suit the power of the animal.

LUBRICATING-WASHER.—C. E. Palmer, Spokane, Wash. The invention is an improvement in lubricating washers. The washers are each supplied with a lubricant in the form of a paste-like substance, such as tallow or other suitable material, and in this manner the parts that are connected together are supplied with grease that will gradually become liquid, and lubricate the wearing surfaces between the connected parts. The washer is especially adapted for use in sprocket chains.

Musical Devices.

UNIVERSAL PNEUMATIC-ACTION. — H. Meyer, New York, N. Y. In this case the improvement relates to self-playing pianos and like musical instruments, the object being to provide a universal pneumatic action capable of use in any make of piano, and arranged to permit convenient and accurate connection between the pneumatics and the individual hammer actions of the piano.

REWINDING MECHANISM. — H. Meyer, New York, N. Y. This mechanism is controlled from the time lever, and arranged to rewind the note sheet without stopping the motor, and to automatically apply a friction brake as soon as the note sheet is rewound, to hold the note sheet under tension during the next following winding up and while passing over the tracker board for actuating the instrument.

PIANO FALL-BOARD.—J. R. A. Lang, Mount Vernon, N. Y. The inventor provides a key board cover rabbeted at opposite longitudinal edges, with the rabbeted portions on opposite faces, and hinge to one edge a front fall foldable in the adjacent rabbeted portion of the key board when the fall board is raised, and hinge at the opposite edge a backfall having a foot movable into the other rabbeted portion of the key board cover when the fall board is lowered.

DRUM AND CYMBAL BEATER.—E. M. Anderson, Victoria, British Columbia, Canada. More particularly the invention relates to drum and cymbal beaters adapted to be actuated by the foot of the operator. An object is to provide a combined drum and cymbal beater, adapted to be operated by the pressure of the foot, and having means for securely holding a drum in position, so that positive blows may be struck upon the drum and the cymbal carried by the drum.

Prime Movers and Their Accessories.

STEAM-TURBINE.—A. Bonom, New York, N. Y. The invention relates to steam turbines and constitutes an improvement on the turbine formerly patented by Mr. Bonom, in which the increase in volume of the steam space can be readily proportioned. The object of the present invention is to improve the general construction of this type so as to facilitate its manufacture. A further object is to provide an arrangement for admitting steam and for controlling the development of power. The turbine also presents improvements in the form of the buckets and guide vanes.

Railways and Their Accessories.

RAILWAY-GATE. — R. Spurlock, Valley View, Ky. In this invention the gate is adapted to be operated automatically by the passage of a train. One of the objects is to provide an improved means for automatically operating the gate pneumatically by the passage of a car or train along a given stretch of track.

Pertaining to Vehicles.

SWIVEL-COUPLING.—B. Henley, Edinburg, Pa. In the present patent the invention is an improvement in swivel couplings. The present invention is an improvement over Letters Patent of two numbers, formerly granted to Mr. Henley for a swivel or pivot coupling adapted to connect two parts that require to rotate upon each other.

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.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12099) W. B. B. asks: To give information that will immensely benefit the public at large, I will be pleased to have you give me as soon as you can look into the matter thoroughly, the best means and best way to lay sewer pipe, and especially the making of cement joints. We have sanitary sewers here, and they are filled with roots that creep into the crevices and joints of the pipe. The pipes laid in this vicinity are placed in position, a little cement placed on the lower half of the bell or socket end of the pipe, and then the next pipe with a string of oakum on it is inserted into the pipe; the balance of the joint is mortared up with cement. The principal information I am seeking is whether the hemp or oakum string is necessary or of any value, or whether a good Portland cement joint is or is not the better way to make the joint. A. Provided the sewer pipe is laid upon a perfectly solid bed, so that the joints are unlikely to be distorted at all (by the filling in of material above the sewer, subsequent traffic over it, or otherwise) we should say that as far as the prevention of the entrance of roots into the joints is concerned, the oakum might better be omitted and a joint of neat Portland cement substituted. It is of course essential that any flow of water through the sewer should be prevented until the cement has had time to set; otherwise a very small quantity trickling through the joints will wash out a small part of the cement and leave interstices in it. The object of oakum or similar fibrous packing is to provide a small amount of give or spring, so that any slight distortion or settlement of the pipe will be compensated by expansion of the packing and will not leave openings nor crack the pipe or flanges; but such roots as you describe are quite capable of growing through the oakum, even when the latter apparently tightly fills the joints.

(12100) W. S. P. asks: Suppose I have a piece of 3-inch square steel 8 inches long and I wish to make a square taper. I clamp it on an angle plate, set square on the planer, with one end higher than the other to make it the desired taper. Now I keep turning it a quarter of a turn at a time, keeping the planed side against the face plates. Now when I have planed all four sides in this manner, will it be square? A. You will make a true taper in the manner described if you keep the axis or center line (or any unplaned side of the square bar) at the same angle to the face plate. Having planed the taper on two sides in the manner you describe, turning the bar through one-quarter turn, you will have two sides of the equilateral pyramid truncated, the top being square but not concentric with the axis of the bar. If you now make another quarter turn, resting the bar on the same blocking and adjusting as before, the tool will not cut the third side of the bar at all if fed through the same range as before, because the bar will rest with one of the tapered sides on the blocking and will be lower by the amount previously cut off. The blocking must therefore be raised by the amount cut off at the point of the bar where it rests on the blocking, and will then be right for the remaining two sides; the final result, without readjustment of the tool, being an equilateral truncated pyramid with a square top concentric with the axis, in other words the taper will be uniform on all four sides.

(12101) W. L. B. asks: In regard to using compressed air for cooling water. I have control of a mill plant here, and we have to drink hydrant water that gets very warm in summer, and we cannot use iced water successfully on account of its being too cold for the men to drink while very hot. We use compressed air at 40 or 50 pounds or 100 if needed, and I believe there could be a way to use it to cool the water, say to about the temperature of good cold well water, as I notice in cool weather (not near freezing) our pump that we run with air instead of steam will freeze up so bad that we have to run a hot-water pipe to it to keep it thawed out. A. The cooling effect of compressed air is due to the physical law that any gas heated by compression and then allowed to cool will, if expanded so as to do mechanical work, lower its temperature and therefore absorb heat from surrounding bodies. If the air has had time to cool after leaving the compressor (or is artificially cooled) it will have a considerable refrigerating effect if allowed to expand. If you place in your drinking-water tank a coil of small pipe open to the atmosphere at one end and connected at the other by a valve to the compressed-air line, the valve being as close as possible to the water, so that all the expansion is in the submerged coil, by leaving the valve just open and a little compressed air constantly escaping through the coil, you should be able to keep a considerable quantity of water comfortably cool.

(12102) C. R. K. asks: Would you please verify the following: Air is in a stationary chamber at 32 deg. with a pressure of 25 pounds per square inch. If the temperature be raised to 212 deg., the pounds pressure per square inch will be 105; and if the temperature be raised to 490 deg. the pounds pressure will be 380. Are these figures correct? If at the start the pressure were 50 pounds per square inch, what would the corresponding results be? A. We regret that we cannot "verify" your figures, which are, if we understand you correctly, entirely wrong, and we cannot see how you derived them. The expansion of air at constant pressure due to increase of temperature is extremely small, and consequently its increase of pressure if the volume remains the same is equally small, amounting to 0.002037 (or two-tenths of one per cent) of its pressure for each degree Fahrenheit through which its temperature is raised. Thus if a given quantity of air has a pressure of 25 pounds at 32 deg. F. (supposing the figures you give to be Fahrenheit) i pressure at 212 deg., volume remaining constant, will be $25 + (25 \times 0.002037 \times 180)$ or 34.1575 pounds. If heated to 490 deg. F. the pressure will be $25 + (25 \times 0.002037 \times 468) = 49.0144$ pounds. If the initial pressure were 50 pounds, the pressure at 212 deg. would be 68.315 pounds, and at 490 deg. 98.0288 pounds.

(12103) R. M. H. asks: Will you kindly answer the following in your Notes and Queries column: 1. For heating a large residence of say 25 rooms, would hot water or steam be the best, and do you know the name of any firm manufacturing such systems? A. We cannot express an opinion as to the comparative advantages of steam and hot-water heating apparatus without knowing more of your conditions. You can best judge by comparing the advantages set forth in the printed matter of manufacturers. 2. Do you know where I can get any books on mechanical drafting? A. As publishers and dealers in scientific and technical books we can supply you with any book published on the subject of mechanical drawing. We would especially recommend the following: "A Manual of Mechanical Drawing," by Johnston, $2; "Mechanical Drawing Self-Taught," by Rose, $4; "Progressive Exercises and Practical Hints in Mechanical Drawing," by MacCord, $4. A still further list is contained on page 28 of our complete catalogue of books. 3. Are the materials used for the explosive in high-power shells of the larger guns stronger than nitro-glycerine, volume for volume, after they are compressed into the shell? A. The basis of most shell explosives is nitro-glycerine, and they are generally rather less powerful than the latter on account of deadening material being added to prevent the accidental explosion of shells by shocks or fire. These matters are kept carefully secret, however, and comparative figures are not available.

(12104) W. C. D. says: I wish to state that the formula for silver plating given in Van Horne's "Modern Electro-plating" is not right, as I followed directions very closely, and in making a gallon solution he says to use 9 to 12 ounces of cyanide 98 per cent, and I found that I had to use double the amount of water, as there was too much cyanide, therefore had to buy more chloride of silver to enrich the solution. A. We find that Langbein's "Electro-Plating," pages 357 and 359, gives much less cyanide per gallon than does Van Horne in the formula to which you refer. Van Horne, however, on page 131, gives the necessary directions for adjusting the bath for working freely, and so one can make a solution by his formula. Langbein gives 6 ounces cyanide per gallon for heavy plating and about 3 ounces for light plating.

(12105) F. L. W. says: Will you please explain why at the solstices the days do not begin to get longer or shorter at both ends at the same time? That is, why in December, for instance, does the sun begin to set later several days before the solstice, but not to rise earlier until several days after? A. The sun begins to set later in December in the afternoon by the clock, because the clock does not indicate true noon. The true forenoon and afternoon are of equal length all the year. True noon is midway between sunrise and sunset all the year. This is determined by the sun, and a sundial will give true noon or midday. The clock does not show the true solar time, but the mean solar time, and it is sometimes ahead of the sun and at other times behind the sun. Only on four days in the year are the clock and sun together. The lengthening of the afternoon in December is reversed in June, since then the forenoon begins to shorten some days before the summer solstice. Both changes are caused by the relation of the equation of time to the time by the sun. This is quite fully explained on page 113 of Todd's "New Astronomy," which we will send for $1.50 post paid.

(12106) A. R. D. says: Will you please advise what is the ratio of drop on water 150 deg. Fahrenheit inside temperature, water 30 deg. outside temperature, and water 60 deg. inside temperature, 30 deg. outside? In other words, which will freeze the quicker—hot or cold water? A. The rate of cooling of water is very nearly proportional to the difference of temperature between it and the temperature around it. If water is 150 deg. and the air around it is 30 deg., the difference is 120 deg. If the water is 60 deg. and the air is 30 deg., the difference is 30 deg. The water at 150 deg. will cool about three times as fast as that at 60 deg. That has no connection with the freezing of either of these waters. When water is cooled to the freezing point, it then must give off a great quantity of heat before it is frozen. It must cool to 32 deg. before it can freeze at all.

NEW BOOKS, ETC.

THE ART OF RETOUCHING SIMPLIFIED. By Ida Lynch Hower. Chicago: A. C. McClurg & Co., 1908. 12mo.; 48 pp. Price, $1.

To know how to retouch negatives is more necessary in this day than ever before, because the photographer's posers are constantly demanding finer and more finished results. The steady improvement in photographic lenses—which have now reached such a high state of perfection—has so increased, that the negative is rare that does not need the manipulation of the retoucher's pencil. This little manual contains practical suggestions from the standpoint of over a quarter of a century of professional training on the part of the author, and the most modern methods and processes have been sought and used.

PRACTICAL TESTING OF GAS AND GAS METERS. By C. H. Stone, B.S., M.S. New York: John Wiley & Sons, 1909. 8vo.; 337 pp., 51 figures. Price, $3.50.

The author has received a large number of requests, at different times and from various men connected with the gas industry, for information regarding the methods, apparatus, and chemicals used in the testing of gas. The first thought was, naturally, to refer the inquirer to some standard work where he would find answers to all of his questions. Careful investigation, however, failed to reveal such a work. No attempt has been made to write a treatise on the manufacture and distribution of gas. The writer's chief aim has been to explain clearly, simply, and fully such tests as would be of practical service to the gas manager, chemist, or photometrist, and to make such comments and suggestions as might guide him in his choice of apparatus or process and assist him to secure accurate and useful results therewith. For this reason all chemical processes, reactions, and calculations have been explained at a length which may seem wearisome to the expert chemist. Many of the later forms of calorimeters, for example, have been described in different technical journals during 1908, and a brief account of these, together with the original reference, is given in the chapter on calorimetry. To the student, whether in the college or commencing work for a gas company, this book may prove a help by leading him by easy journeys over the rather troublesome roads of photometry, calorimetry, and the chemical analysis of gas.

THE ART OF MAGIC. By T. Nelson Downs. Edited by John Northern Hilliard. Buffalo: The Downs-Edwards Company, 1909. 8vo.; 342 pp. Price, $5.

The author has produced a book which treats of standard tricks, also many novelties. The volume before us deals almost entirely with card tricks, tricks with coins, and tricks with a wand. It does not trespass on the field of Hopkins's "Magic," which considers more particularly the other and more complicated tricks requiring more or less elaborate paraphernalia, so for this reason we believe that the book will prove of value to those who are already in possession of "Magic."

THE NEW INTERNATIONAL YEAR BOOK, 1908. Frank Moore Colby, M.A., Editor, assisted by various special contributors. New York: Dodd, Mead & Co., 1909. 8vo.; pp. 776; 47 full page illustrations, 9 maps.

The 1908 issue of the New International Year Book is the second of a new series of annual volumes which was arranged to follow the publication of the New International Encyclopedia, and it is to be hoped that it will be maintained without the interruptions that have detracted much from the value of these and other annual records that have been attempted in this country in the past. A distinct policy of continuity is most essential for a work of this kind, and invaluable as it is, as a supplement to an encyclopædia or other reference work it should be compiled and judged solely on its merits as an authoritative record of the year. The New International Year Book for 1908 contains a summary of the progress of the world for that year in all departments of history, art, literature, and science, so that it affords the busy man a conspectus of what has happened in any field during the twelve months under review, and enables him to read his newspaper with an appreciation of previous events. In this way the Year Book thoroughly prepares the general reader for understanding any political crisis, such as the dethronement of the Sultan in Turkey, while its discussion of the presidential campaign in the United States is a valuable contribution to American political history and will prove of marked assistance to one who would understand current politics without undue study and reading. Thus the book should be very useful to the scientific man, as it enables him to keep in touch with developments in the world of politics, art and literature with a minimum of effort. All of the articles are prepared by recognized authorities in their special fields, and in pure and applied science the articles are specially valuable, not only in themselves but as forming an index to the progress of the year and indicating the most important work accomplished. It might be of assistance to the worker in science, as doubtless to the student of history and economics, if detailed and exact references in the form of foot-notes or otherwise were made to original authorities, though this might detract from the popular and unmistakably interesting character of the book. The reviews of the progress of Astronomy, Scientific Agriculture, Botany, Chemistry, Physics, and Psychology, to mention but a few of the scientific articles, seem specially well prepared, while interesting articles on Automobiles, Aeronautics, Bridges, Fire Protection, Railways, Military and Naval Progress, and Shipbuilding all show that the record of 1908 in applied science was not inconsiderable.

WHEN RAILROADS WERE NEW. By Charles Frederick Carter. New York: Henry Holt & Company, 1909. 12mo.; 324 pages. Price, $2 net.

A fascinating history of the struggles and fantastic failures and the final triumphs of the pioneer railroad builders is now gathered together for the first time in book form. No attempt is made by the author to follow the vicissitudes of all the railway schemes, but he follows graphically the history of those roads which best typify the processes of evolution and the characteristic circumstances up to where the story ceases to be romantic and commences to be commercial and commonplace. It is not primarily a book of reference, but is a highly interesting narrative for the general reader. What is strangest is that the general reader might search in vain for any satisfactory account of how the railroad first came to America, how it was built and how it was run, how the early pioneers struggled with poverty, ignorance, and other inevitable obstacles and blundered and struggled on again until at last they had developed a method of transportation that measured by its influence on civilization is the greatest achievement in the annals of the race. All the important inventions relating to railroading appear to be claimed for several men. Thus the four-wheel truck was claimed by three men. One of them obtained a patent for the device and then spent a fortune trying to protect it, only to find out in the end that he was not entitled to it. All the early stories seem mythical. At the outset the first engines ran only on fair days and they were replaced by horses on rainy days by the proud but prudent owners, says one account. This story is, however, considered to be legendary by some authorities—the first engineer claiming that he ran his machine every day, rain or shine. The titles of the chapters are "The Dawn of the Railroad Era," "America's Pioneer Railroad," "Early Days on the Erie," "The Pennsylvania Railroad," "Genesis of the Vanderbilt System," "Incubator Railroads," "The Frst Continental Railroad," and "Romance of a Great Railroad." There are a number of excellent half-tone illustrations.

THE PHOTOGRAPHY OF COLORED OBJECTS. By C. E. Kenneth Mees, D.Sc. New York: Tennant & Ward, no date. 69 pp.; 12mo.; 14 plates; color chart; photogravure frontispiece; stiff paper covers. Price, 56 cents.

Although written from the English standpoint, Dr. Mees's book contains much that is of value to the American student of photography. The first chapter, on the nature of colors, and the second, on sensitiveness to colored light of the eye and of photographic plates, discusses the physics of color. The fourth chapter tells how color contrasts are rendered. The fifth deals with portraiture, and the sixth discusses photography of colored objects for reproduction. The remaining chapters are devoted to landscape photography and tricolor photography. While not employing purely scientific nomenclature and phraseology, Dr. Mees has made no attempt to be practical, on the principle that the application of an ounce of accurate knowledge is worth a ton of unreasoning practice.

STORY OF THE CATACOMBS. By Florence Edythe Blake-Hedges. Cincinnati: Jennings & Graham, 1909. 12mo.; 148 pages. Price, $1 net.

The Catacombs of Rome always have a fascination for American tourists who visit them in order to see the first examples of Christian art, and also because the foundations of much of the Christian religion were laid in these early worshiping places. The present work is a pleasing little volume, which serves as an introduction to those who are unfamiliar with the great volume of the remains to be found in the city of Rome and the Campagna. It is rather prettily printed on tinted paper.

HOW TELEGRAPHS AND TELEPHONES WORK By Charles R. Gibson. Philadelphia: J. B. Lippincott Company, 1909. 12mo.; 156 pages. Price, 75 cents.

A small book written in simple non-technical language, dealing with telegraphs and telephones, such as would be useful to those who are specially interested in those instruments. A chapter on wireless telephony, and a short discussion of the electron theory, bring the volume thoroughly up to date.

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SOME TRICKS OF THE MOVING PICTURE MAKER.

(*Concluded from page 477.*)

apparently look through the glass. They see the matches burning—this time the property matches—with a stream of water playing upon them, and the fairy falling backward and disappearing.

The final scene discloses the man squirting seltzer on the smoking matches, and in his anxiety to extinguish them completely deluging himself.

The effect of "The Princess Nicotine" when thrown upon the screen is so startling that it defies explanation by the uninitiated. The little fairy moves so realistically that she cannot be explained away by assuming that she is a doll, and yet it is impossible to understand how she can be a living being, because of her small stature. The illusion is heightened by the enormous size of the property cigarettes, matches, and corncob pipe compared with the diminutive size of the fairy. Naturally, in enacting this photographic play it is most important that the two fairies should act their parts faultlessly. Thus, when the girl is shown in the bottle, she must never move outside of a certain square marked on the platform upon which she stands beside the camera. Otherwise, she would no longer be seen in the bottle, but outside of it, and the illusion would thus be destroyed.

Again, when she hands her property cigarette to the man, and he apparently takes it, she must hold her hand, and the man his hand, in the proper position, so that the real cigarette and false are superimposed.

In other moving-picture plays it is sometimes necessary to produce effects which are not required in the "Princess Nicotine." Thus, in one film story, a robber is required to run 100 yards down the street, while the apparatus is in operation. If the crank were turned at the usual rate, about 900 pictures would be taken. In order to produce the impression of still greater speed, the film maker simply cuts down the number of pictures to 600, so that the robber runs the 100 yards with outrageous leaps and bounds.

The coloring of films may also puzzle many. The tinting is more simply done than may be supposed. Three positive prints are made from the negative. Out of each picture of the positive a section to be colored red is cut. From the second film, a different section is cut, which is to receive a blue color. Out of the third another part is cut, to receive yellow. Three positive stencils are thus obtained, each having perforations made by cutting away a particular section in each picture throughout the entire length of the film. The fourth positive is now colored by means of the three stencils. The film to be colored is passed slowly over paint rollers in contact with the first stencil, color being applied exactly in the same way as with ordinary stencil plates. The operation is repeated for the second and third stencil film, so that the positive is run over the rollers three times, each time receiving a different color through different perforations. The final result is a positive film in three colors.

RECENT FRENCH AEROPLANES AND THEIR PERFORMANCES.

(*Concluded from page 481.*)

flight of 2 hours and 20 minutes on December 31st last) and is significant from the fact that it was made with a monoplane, which is generally considered to be the most advanced type of aeroplane. The day before, Mr. Latham made a 37-minute flight at a height of from 60 to 75 feet, and the day after—June 6th—he won the Goupy prize for a flight of 5 kilometers (3.1 miles) in a straight line across country, covering this distance in 4 minutes and 13 seconds at a speed of about 44.1 miles an hour. The entire flight lasted 14 minutes. On June 7th he made four flights of 600 meters (1,968 feet), 700 meters (2,297 feet), 3 kilometers (1.86 miles), and 12 kilometers (7.46 miles) respectively. In each of these flights he carried a passenger. The last flight was of 11 minutes 6 seconds' duration, Mr. Latham's companion in this instance being Mr. F. Hewartson of the London Daily Mail. The latter sat facing backward in front of Mr. Latham, and so steady was the flight of the machine, that he was able to make stenographic notes while in full flight. Even with the extra passenger, the aeroplane had a tendency to soar, but this was easily checked by means of the horizontal rudder.

The other monoplane shown in flight is the new No. 12 machine of M. Louis Blériot. This monoplane has a length of 10 meters (32.8 feet), a spread of 12 meters (39.4 feet), and its weight with two men on board is given as 498 kilogrammes (1,098 pounds). The thrust obtained from the propeller (which in this case is chain-driven from a 30-horse-power, 8-cylinder water-cooled motor mounted in the lower part of the body framework) is 73 kilogrammes (161 pounds). The first test was made on May 21st. The machine flew successfully at its first trial. Since then it has been altered somewhat. Our photograph shows it in its altered condition. The vertical rudder has been moved from the extreme end of the body framework to a point about half way between the two ends, and has been placed above the frame. The horizontal rudder has been placed below the body framework near the rear, while there is a second one below the aviator's seat. A fixed horizontal surface is located above the body just below the vertical rudder. After making successful flights with a passenger, M. Bleriot, on June 12th, is reported to have flown 1,000 yards at a height of from 15 to 20 feet, carrying two passengers, the weight of the machine with passengers being in this instance 1,232 pounds. This was a very remarkable performance, and it is the first time that an aeroplane is known to have carried more than two men. The passengers taken by M. Blériot were M. Fournier and Santos Dumont. M. Blériot is continuing his experiments, and he will, no doubt, make some record flights before long.

The biplane, shown in flight, is one of the Voisin machines, such as was first used successfully by Farman and Delagrange. The particular one shown in the photograph is that of M. De Rue. It has made some excellent flights at the new aviation field of the Aero Club of France at Juvissy, and in the picture is shown winning the Archdeacon cup.

The biplane shown on the ground is a new machine, having planes which are arched from the center outward in a peculiar manner, as can be seen from the picture. This arching of the planes also extends to the tail in the rear. A large four-bladed propeller is placed just back of the main planes, and is driven by a chain from the motor. The designer, M. Lepetit, expects to increase the transverse stability by means of the arching of the planes. The machine has not yet received its initial test. It has two runners below the tail, and two runners with wheels in front.

THE CONSTRUCTION OF THE ZEPPELIN AIRSHIP.

(*Continued from page 481.*)

partments contains a separate gas bag. These gas bags are well shown in the picture at the front end of the airship. They fit the compartments, and press against a network of ropes (not shown) within the girders. Outside of these girders there is a covering of special balloon cloth. On the under side of the frame there is a trussed keel, extending to within two compartments of each end. The two cars are suspended from this trussed keel, and rigidly attached to the same about a quarter of the way back from the bow and a quarter of the way forward from the rear end of the airship. Each car contains a 110-horse-power motor, which drives, by means of shafts

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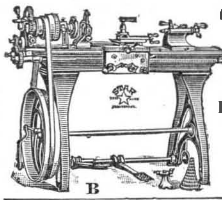
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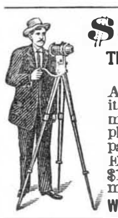
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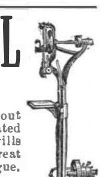
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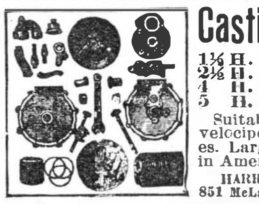
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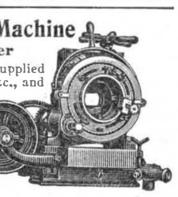
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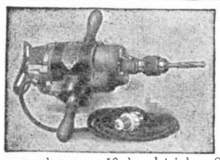
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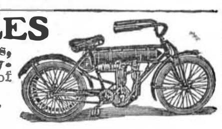
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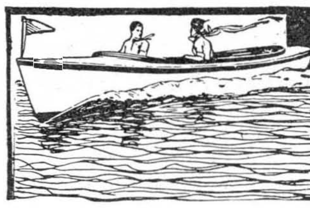
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MISCELLANY.

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and bevel gears, two propellers—one on each side of the airship. A reversing mechanism is provided, by which it is possible to reverse the propellers; and after the accident at Goppingen, in which the bow of the airship was badly damaged, the huge craft was, it is said, driven backward to its destination, some 150 miles away.

The total length of the "Zeppelin II" is 136 meters (446 feet). Its gas capacity is 15,200 cubic meters (536,773 cubic feet) and its lifting power is consequently about 16 tons. Its journey from Friedrichshafen almost to Berlin was cut short on account of lack of fuel; and while attempting to land in a rainstorm the accident occurred, the balloon smashing into a tree. The fact that Count Zeppelin was able to repair the damage within twenty-four hours and return to Friedrichshafen was a complete vindication of the advantages of the rigid-frame type of airship. Any other type of dirigible balloon would have been effectually demolished by such an accident as the "Zeppelin II" met with.

For further particulars of the constructional details of the recent Zeppelin airships, we refer our readers to SUPPLEMENT No. 1745. The "Zeppelin II," while an entirely new craft, has some of the parts used in the "Zeppelin IV," which was demolished last August. Its speed is fully as great as was the speed of that craft, and after repairs have been made, it will probably make some excellent long-distance voyages. Plans are on foot for the establishing of a regular airship line between several of the large German cities; and there is another new Zeppelin airship nearing completion for exhibition and flights at the Frankfort Exposition, which opens in July.

Action of Brick Kiln Gases on Vegetation.

For years the brick makers of French Flanders have been paying indemnities to neighboring farmers for the damage done to crops by the gases discharged by the brick kilns. The greatest damage is done in foggy weather and during the precipitation of dew. No injurious effect on vegetation is produced by lime kilns situated near the brick kilns and using the same coal.

It appeared evident that the injurious constituent of the products of combustion was made harmless by lime, and it was suspected that this ingredient was sulphur dioxide, formed by oxidation of the pyrites contained in the fuel. This gas, if sufficiently diluted with dry air, does not injure vegetation, but in a moist atmosphere it becomes converted into sulphuric acid which destroys all vegetation on which it falls. In the lime kilns the sulphur dioxide combines with lime to form calcium sulphite, which remains in the kiln.

This theory was confirmed by experiment. Wet cloths were hung to windward and leeward of a brick kiln for a time and the moisture wrung from them was analyzed. Sulphuric acid was found in the leeward but not in the windward cloths. The obvious remedy for the existing state of affairs, therefore, was the addition of a sufficient quantity of lime to the brick kiln. This plan was adopted last season by several brick makers with great sucess and at a cost of only two or three cents per thousand bricks. In addition to the prevention of injury to vegetation, it was observed that the workmen suffered less from the effects of heat and discharged gases, drank less, and enjoyed better health than formerly.

The American Medical Association has voiced its protest against the use of benzoate of soda in food. A delegation of the Association, headed by Dr. C. A. L. Reed, of Cincinnati, recently called on President Taft and recorded their protest. The stand taken is that factories and plants where food products are prepared should be the subject of federal inspection.

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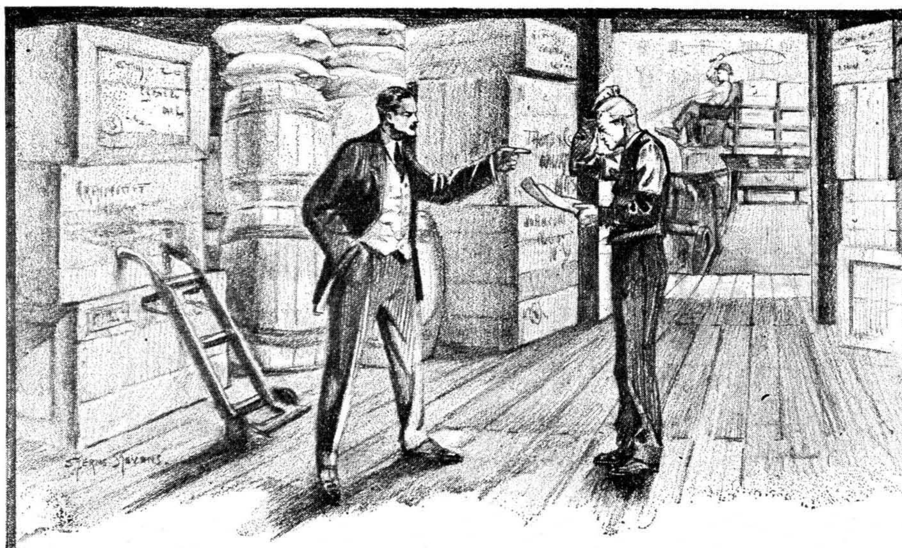

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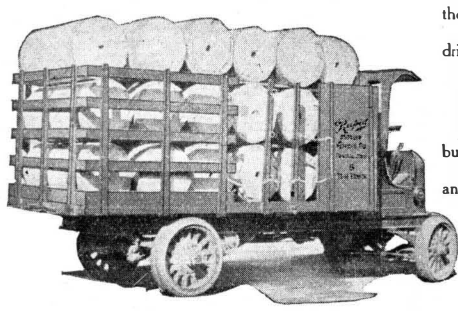

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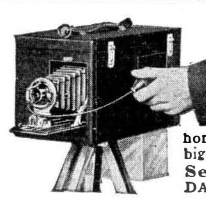

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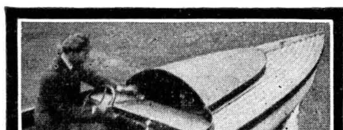

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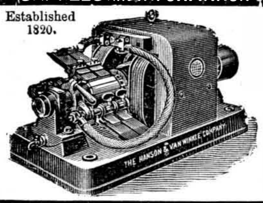

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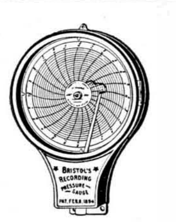

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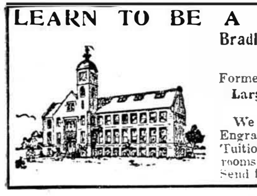

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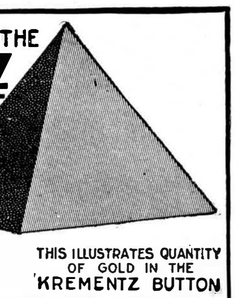

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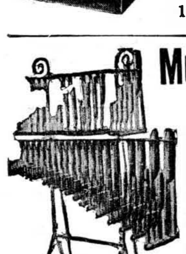

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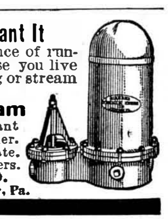

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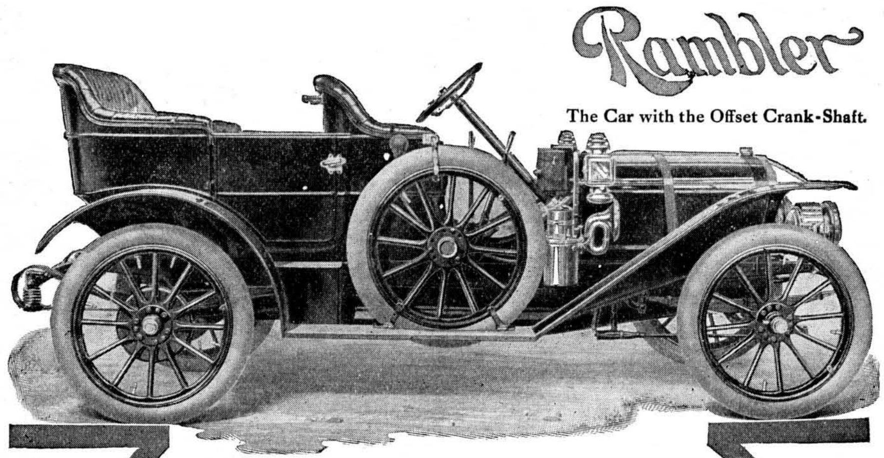

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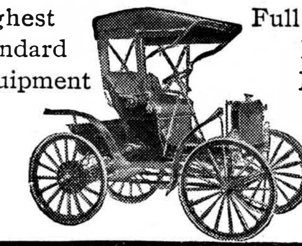

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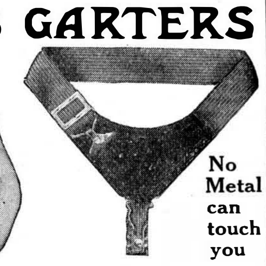

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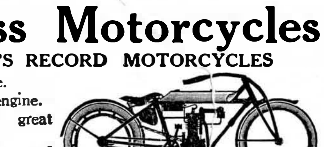

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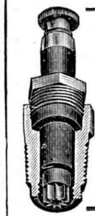

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