SCIENTIFIC AMERICAN

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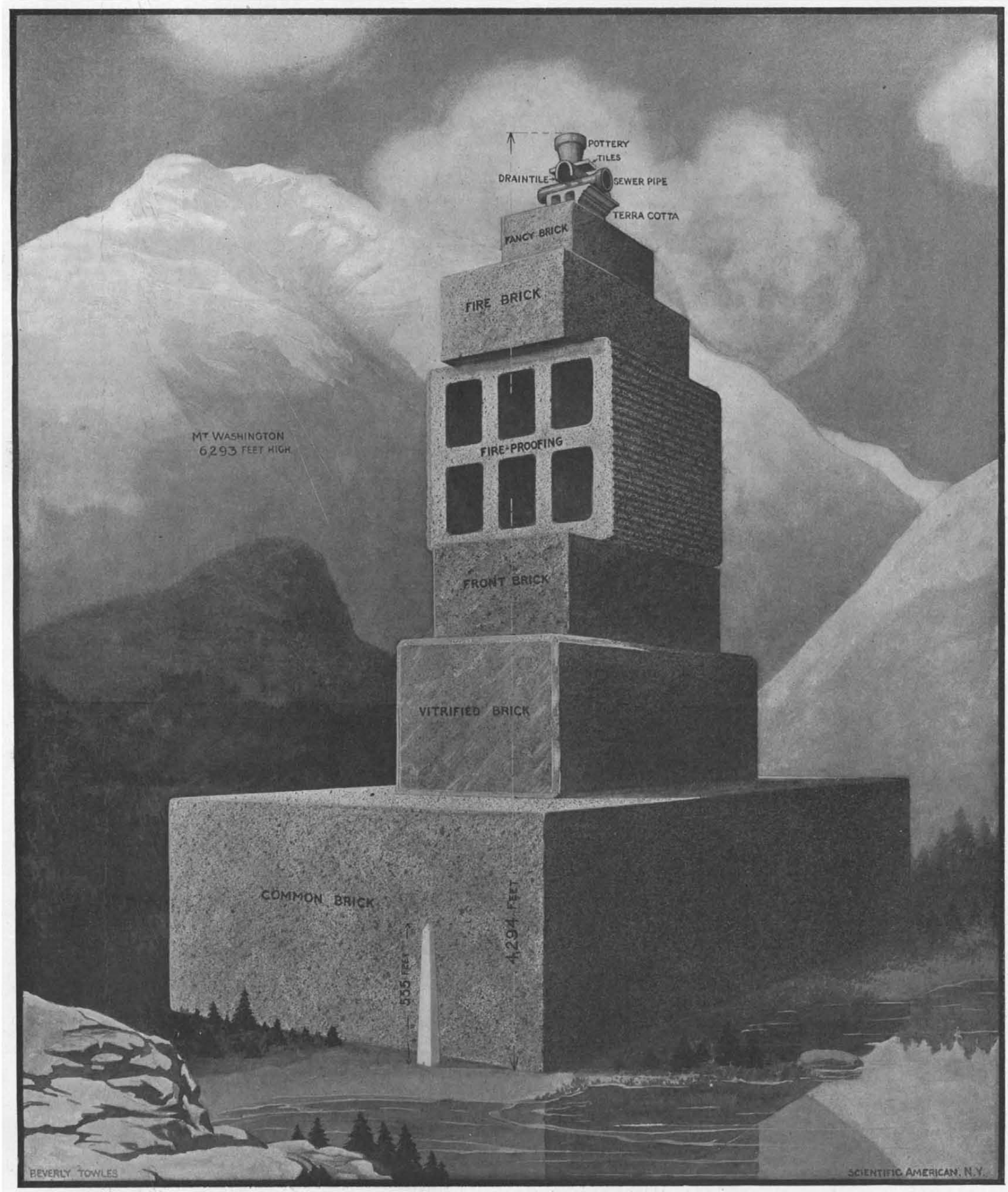

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CLAY PRODUCTS OF THE UNITED STATES.

The pyramid of burned clay would be 4,294 feet high and represents a value of $158,942,369.—[See page 98.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, JANUARY 30, 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.

THE GATUN DAM MISREPRESENTATIONS.

If it is any satisfaction to the critics, who have recently tried to persuade the people of the United States that the present plan of building the Panama Canal will result in disastrous failure, to know that they have succeeded in imposing on the country the cost of a highly expert commission of engineers, appointed to accompany Mr. Taft to the Isthmus, the probability is that this is all the satisfaction they will derive; for there is but little doubt in the mind of any candid engineer who has examined into the latest data, furnished by Col. Goethals and his band of very able assistants, that the lock canal as now being constructed will be indorsed by Mr. Taft's commission. Certainly the SCIENTIFIC AMERICAN has no anxiety as to the permanence either of the Gatun dam, the locks, or the canal as a whole. We go even further than this, and assert our belief that, by the time the canal is finished, it will be impossible to find a similar engineering work, which has been subjected to such a searching preliminary investigation of the debatable elements of its construction, as this canal has received and is at present undergoing. Nothing has been taken for granted, and millions of dollars are being spent in preliminary investigation, meteorological, geographical, geological, and physical; with the result that by the time of the opening of the canal in the year 1915, the people of the United States may be perfectly satisfied that this, the world's greatest artificial waterway, will be as lasting as the hills which surround it and the two great oceans which it has linked together.

These being the facts, we cannot but feel that the time has come to utter a word of strong protest against the yellow-journal methods which have been adopted by certain professional men, in endeavoring to raise a doubt in the unprofessional—and that means the majority of the public—mind, as to the character of the work being done at Panama. It is not a difficult matter to arouse popular apprehension concerning hydraulic works of great magnitude. It is rendered easy by the fact that the problems involved are often difficult and obscure, and the results of failure usually include large losses in life and property. Because of its great distance from the United States, and because of the fact that this stupendous engineering work is being built in a tropical country, whose physical characteristics and climatic conditions are strange to the people of the United States, the public mind is acutely sensitive to alarmists' rumors, particularly if they are uttered by men whose technical knowledge and wide experience in works of this character would seem to qualify them to speak with authority.

We regret to say that the character of the professional attacks now being made upon the canal arouses a serious doubt as to their being based upon conviction and made in good faith. It is significant that the most bitter opposition has come from men who have their own pet schemes, either for a different type of canal, or a different method of construction. In each case these critics received an impartial and extended hearing before the Isthmian Canal Commission, to say nothing of large opportunities of presenting their views to the world through the medium both of the technical and non-technical press. If these men have failed of conviction they are, of course, entitled to maintain their critical attitude; but the ethics of debate, and particularly of professional debate, demand that their criticisms be presented in a frank and fair spirit, free from any suspicion of subterfuge; and we claim that it is subterfuge to select isolated statements from the published reports of the investigation and experiments of the engineers, separate them entirely from their context, and impart to them a meaning which they were never intended to convey.

As specific instances of this deliberate misleading of the public by the time-honored method of throwing dust into its eyes, it is sufficient to note two notorious instances. During the sinking of borings to ascertain the character of the foundations of the Gatun dam, a small quantity of water appeared in some of the holes. It was insignificant in amount, rose only a small distance in the holes, and was found to be restricted to a few limited areas. Yet, on the strength of this fact, the rumor was started that the whole of the dam was founded upon a "subterranean lake"! Again, in preparation for the depositing of the material of the dam by the hydraulic method, the engineers built a rock fill across the valley along the upstream and downstream edge or toe of the dam, the object of which was to retain the solid material, as it was deposited by the hydraulic dredges, and prevent it from washing away with the water as the latter drained away from the dam. During the progress of the fill across the valley, it encountered the channel of the old French canal, which during the past twenty years had become filled with silt and mud. The engineers determined that it would be cheaper to dump the rock into the mud and let it sink to a solid foundation, than to excavate the mud beforehand. Accordingly, the fill was carried across the old channel; and, as soon as the load imposed was sufficient, the material sank, as the engineers expected and desired, displacing the mud on either side, until the rock rested ultimately on the firm underlying ground. No sooner was this trivial event, which had no significance whatever as affecting the future permanence of the dam, cabled to the United States, than it was seized upon, worked up into an alarmist article which, because of its pseudo-technical flavor, was well calculated to arouse public apprehension, and was distributed broadcast to the press.

The visit of Mr. Taft and his Board of Engineers to the Isthmus will have the desired effect of allaying the public apprehension, which has been aroused by such misrepresentations as we have above referred to. But we are satisfied that, as far as the great body of civil engineers in this country is concerned, the facts which have been developed by the surveys and experimental work of the past few years, so far from shaking their faith in the practicability of the present lock-and-lake canal, have strengthened it immeasurably.

THE NINTH ANNUAL AUTOMOBILE SHOW IN MADISON SQUARE GARDEN.

The ninth annual automobile show in Madison Square Garden was held this year, as usual, by the Licensed Association of Automobile Manufacturers, two weeks after the show of the American Motor Car Manufacturers' Association in the Grand Central Palace. Although the demand for space was greater than ever, and every nook and corner was filled, the exhibition as a whole was not especially interesting, particularly as far as novelties were concerned. There has been no change from standard design by any of the leading makers. They have contented themselves with improving the details of their cars wherever possible, as is shown in the case of the ignition of the motors, which has been rendered more reliable by the general adoption of magnetos. A coil and battery system is generally fitted for reserve, and this being the case, we believe that many owners of cars will be interested in an improved ignition and lighting system, which is intended to replace the magneto. A substantial multipolar dynamo, which weighs 8 pounds less than the usual magneto, is geared direct to the engine, or driven from the flywheel by means of a friction pulley with a governor. A special current-governing device makes it possible to set the charging current at any desired figure up to 10 amperes, while an automatic switch closes or opens the charging circuit when the dynamo starts or stops. In this way the 6-volt storage battery can always be kept charged, and used as a source of current for all the lights of the car, including 30- or 40-candle-power tungsten-filament headlights. An electric siren or horn may also be used.

In addition to a special high-tension ignition apparatus without vibrators, that is run from dry batteries and that produces but one spark in each cylinder in order to ignite the charge, a distinctly new device of somewhat the same character was shown. This new apparatus consists of an ordinary low-tension spark coil with but a single winding, which is used in connection with very small individual spark coils attached to the spark plugs. The first coil is provided with a condenser, and has one end of its winding grounded through the battery, and the other end connected to the center plate of a commutator, the four insulated poles of which are connected to the primaries of the four small spark coils. The condenser discharge, in addition to the regular current, passes through these coils, and produces an oscillatory spark in the secondary at the plugs. This spark is very rapid, and it also has the peculiar quality of not shocking one, as does the ordinary jump spark. The apparatus does away with vibrators, and while there is but one spark, it is sufficiently intense to have excellent igniting qualities.

Shaft drive has become even more popular than magneto ignition, for all but three of the thirty firms exhibiting touring cars showed shaft-driven cars, and twenty-one of them showed this type exclusively. Only cars of the heaviest and most powerful kind were fitted with a double chain drive. In the matter of transmissions, the selective sliding gear type is most widely used. These transmissions generally give three speeds forward and one reverse; but fourteen of the twenty-nine gasoline touring car makers showed machines fitted with transmissions having four speeds forward and one reverse.

The six-cylinder engine, while it has not increased in numbers very largely, has nevertheless become a favorite with many. Nine firms exhibited cars of this type, and one of them especially will build only six-cylinder cars during the present year, as it did last year. The only firm producing air-cooled cars that exhibited also had a six-cylinder machine, while the one firm producing a two-cycle car showed a three-cylinder two-cycle engine, which is, of course, equivalent to a six-cylinder of the four-cycle type. The practice of casting the engine cylinders in pairs is followed by twenty-two makers, while eleven showed separately cast cylinders, and two exhibited engines cast in one piece. Low-tension make-and-break ignition was found on the engines of but four makers.

There were not so many popular-priced cars exhibited as at the Grand Central Palace Show. But five manufacturers showed four-cylinder touring cars, ranging in price from $1,850 down to $1,400. The only other low-priced machines were a single-cylinder touring car at $950, and a two-passenger buckboard at $350. The large majority of machines ranged from $2,500 to $3,500 in price.

A striking feature of the show was the exhibit of motor bicycles in the basement. A score of different makes of machines were exhibited. There were two makes of four-cylinder motorcycles, and one machine equipped with a three-cylinder engine, the cylinders of which had a fan-like arrangement. The majority of the machines were fitted with single-cylinder or V-type engines.

A number of commercial vehicles were shown in the basement, among them being a huge fire-hose wagon for the New York city high-pressure system. The electric vehicles were also numerous, there being no less than eight different makes on view.

THE LABOR INVOLVED IN LIQUEFYING HELIUM.

Few more telling examples of the modern physicist's dogged patience can be found than Onnes' feat in liquefying helium. The achievement is noteworthy, not because any new light was shed on the physics of gases, but because of the painstaking methods employed. Dr. Onnes started at six in the morning. For seven and three-quarter hours he labored to get twenty liters of hydrogen before the real experiment could begin. Between seventy and a hundred liters of liquid air were necessary for the cooling of the helium gas. Liquid air boils at 60 deg. C. absolute; hydrogen at 23 deg. C. The difficulty was to lower the helium down this heat precipice. Under the intense cold, the pressure of the helium fell from 100 atmospheres to 40, and still there was no trace of the formation of a liquid; but as the last lot of liquid hydrogen was introduced the temperature fell to 5 deg. absolute, and then with difficulty Dr. Onnes was able to discern the layer separating liquid from gas. It stood out with the sharpness and precision of the edge of a knife—about sixty cubic centimeters of liquid, which the physicist kept under observation for about two hours. He exhausted it with a pressure of between 2.3 centimeters and 7 millimeters of measure; but no solid was formed, and the liquid remained mobile, with a density of 0.15, the ratio of its volume to the volume of the gas being as one to eleven. At the temperature achieved in this experiment, hydrogen would become as solid as granite. There is great need for further investigation. As Sir James Dewar remarked before the British Association, it is fitting that the final resolution of the last recalcitrant gas should be the work of a Dutch scientist, for it was on the work of Van Dir Waals that the methods for the liquefaction of gases were largely based.

In the matter of the purchase of an automobile, the questions to be considered are the weight and the horse-power. Other things being equal, a motor car should average less than one hundred pounds to the horse-power, and it follows that the lighter the weight of the car, when materials are not sacrificed in its construction, the greater will be the economy in fuel and tires.

ENGINEERING.

The Secretary of War has recommended the removal of what is known as Middle Ground, a series of obstructions to the navigation of the East River, 1½ miles to the east of Hell Gate. A depth of 17.8 feet has been secured over this ground by work initiated in 1893. The Secretary recommends that this depth be increased to 26 feet at a cost of $1,733,080. The blasting away of the reef will remove a serious menace to the shipping which uses the inside route by way of Long Island Sound.

That the rate of excavation of the Panama Canal is greatly dependent upon the rainfall, is shown by the increase in the amount of material removed in December over that taken out in November. During the former month, when there was a precipitation of 11.66 inches, the excavation amounted to 2,920,494 cubic yards. In December, when the total rainfall was 5.93 inches, the total excavation exceeded that of November by 343,179 cubic yards and amounted in all to 3,263,673 cubic yards. This is only 216,597 cubic yards less than the highest record, made in March last, when the total was 3,480,270 cubic yards.

So serious is becoming the question of supplying ties for our railroads, that the Santa Fé system recently sent its manager of the timber and tie department on a tour to the Orient and Europe, to make a study of conditions. It was learned, among other things, that three hundred years ago the Japanese government began to conserve its forests; and that, as a result of its foresight, Japan is now selling ties to railroads in this country and Mexico. There is a duty of twenty per cent on each tie imported into the United States. That we should be paying a twenty per cent duty on ties is one among many constantly accumulating evidences of the thoughtless extravagance with which our magnificent timber supply has been ruthlessly swept away.

The statistics of British shipbuilding during the year 1908 show that the depression of leading industries was by no means confined to this country. The total tonnage of vessels launched in 1906 in Great Britain was 1,828,090 gross tons; in 1907, 1,607,890 gross tons were launched; but in 1908 the total fell to 902,756 gross tons. This, as compared with 1906, represents a falling off of 50 per cent, and about 44 per cent as compared with 1907. Well may our contemporary, the Shipping World, speak of this as "an appalling decline, and the most depressing, unprofitable and unsatisfactory year in the history of this great British industry."

In a paper read before the recent road congress in Paris, H. P. Maybury stated that reliable roads suited to modern traffic would be secured by building them as strongly as possible; reducing the camber to a uniform 1 in 30; coating the surface with the best obtainable hard material, gaging not less than 2 nor more than 2½ inches, and thoroughly rolled; using only clean, hard gravel and chippings as the binding agent; then cleaning the surfaces and applying a dressing of a heated tar compound; and finally covering the surfaces thus treated with hard, clean gravel or granite chippings and thoroughly rolling with a steam roller. His experience has proved that such a surface is cheap, almost dustless, and provides good traveling for traction engines and commercial motors and a good footing for horses.

The general manager of the underground system of London, formerly general manager of the Public Service Corporation of New Jersey, who is now in this country, states that during the rush hour trains are run at closer intervals, namely 90 seconds, than they are during the rush hour on the New York subway. The tubes, of which there are altogether about 100 miles in London, vary from 80 to 180 feet in depth below the surface. They are served by large elevators, which are worked in connection with the train schedule by means of a system of signaling. There are also 80 miles of subway, built, like our own Rapid Transit system in New York, just below the street surface. This system, much of which was built and in operation over fifty years ago, was originally operated by steam; but within the last few years it has been equipped for electric traction.

Gen. Allen, Major Squier, and Lieut. Lahm recently appeared before a Senate Committee and made a strong plea for the appropriation of $500,000 for the development of the aeronautical branch of the work of the army signal corps. The astonishing strides made by both the dirigible and the aeroplane during the past year have established the practical character of these machines, considered in regard to their military possibilities. Enough has been done to make it certain that aeronautics will figure largely in future military operations. Just how largely, or in what way, it is too early to determine; but sufficient demonstration has been made to render it imperative upon our government to keep abreast of the foreign powers in developing this new arm of the service.

ELECTRICITY.

The tunnel under Washington Street, in Boston, has been equipped with a very complete telephone installation which is open to the use of the public. There are twenty-four pay stations at the eight railway stations of the tunnel. The booths are provided with the three-slot type of instrument, and are entirely automatic in their operation.

The British Meteorological Office has arranged with shipping companies to report the condition of the weather on the Atlantic by means of wireless telegraphy. The ocean is divided off into numbered areas, and the number of the section is to be given with each report. This will enable the office to make more accurate forecasts of weather conditions.

A Swedish transmission line has recently been installed in which over certain sections a cable is used in which a hemp core is imbedded. It is claimed for this cable that the strain is distributed more uniformly than with a wire core. This cable is used only at road crossings and is calculated to overcome danger due to the line breaking at such vital points.

The Health Department of Chicago has been making a series of experiments with various car-ventilating systems. Four different types of ventilators have been examined, and these have been described in their recent report, although the preferred system has not been indicated. The department has come to the conclusion that ventilation is a necessity, and should be required on Chicago's railroads.

An interesting hydro-electric plant has been installed on the Kerka River, in Dalmatia, Austria-Hungary, to generate electricity used in the manufacture of carbide. A novel feature of this plant is that in order to do away with transformers high-potential three-phase generators are used, producing electricity at 30,000 volts, which is fed directly into the transmission line. The latter is 21 miles long.

Under the new régime in the Turkish empire the restrictions on electrical apparatus, of all classes, have been removed. The government is planning to establish a telephone service similar to its telegraph service. This is a very interesting illustration of the advance of the Turkish government, which heretofore has had a particular dread of electricity owing to its connection with the word *dynamo*, which obviously must have something to do with dynamite.

Electrical fireboats have been put into service in Chicago. The boats are driven by two electric motors operating independently the twin screws. The current is supplied by generators direct-connected to steam turbines. Directly coupled to each generator set is a centrifugal fire pump. The particular advantage of using electricity for these boats is that the command of the vessel is entirely under the direct and immediate control of the captain. This is particularly important in the congested Chicago River.

Our consul at Nantes, France, reports the use of the telephone in fishing in Norway. A special form of microphone is used, which is inclosed in a thin watertight steel box, kept in communication with a telephone receiver on the fishing boat. By means of this apparatus, the fisherman is informed of the approach of fish by the peculiar sound produced in the instrument. A whistling sound indicates the approach of herring, while a sort of grunting sound announces the arrival of codfish in the neighborhood.

Consul-General A. W. Thackara, of Berlin, reports the following charges for wireless telegraph messages at German coast stations: Besides the regular telegraph rates of 5 pfennigs (1.19 cents) a word, minimum price 50 pfennigs (11.9 cents), there is a charge of 15 pfennigs (3.57 cents) a word, minimum 1.5 marks (35.7 cents), and if the message is sent to a steamer which can be reached from the coast station an additional toll of 35 pfennigs (8.33 cents) a word, minimum 3.5 marks (83.3 cents), is charged.

One of the problems which has arisen in connection with the construction of the House and Senate office buildings in Washington has been a method of transporting Congressmen from their offices to the capital. A subway has been built, and it was first proposed to install a small electric railway in the tube. But the plan was abandoned because of the noise of such a system. It is now proposed to provide small rubber-tired electric cars, furnished with storage batteries, which are so constructed that they can be used for carrying freight when not otherwise needed.

The government telegraph lines in France have adopted a system of charging only one centime or a fifth of a cent per word for messages dispatched at night. This rate applies to messages containing at least fifty words. In this way it is hoped to keep the wires almost as busy at night as in the daytime. The value to the commercial world will be that a business man can send by telegraph a communication, comparable in length with an ordinary letter, and at but little over regular postage rates, with the assurance that the message will be delivered the very first thing on the following morning.

SCIENCE.

The eighth moon of Jupiter, discovered only within the last two years, has been photographed at the Greenwich Observatory. The satellite has been photographed but few times since its discovery and the determination of its position now accords with previous computation of its position by astronomical methods.

An apparatus has been invented for measuring the elasticity and the hardness of India rubber. The elasticity is determined by dropping a steel ball on the rubber from a measured height, H, and observing the height, h, to which the ball rebounds. The ratio $\frac{h}{H}$ is proportional to the elasticity. The hardness is determined by forcing a sharp point into the rubber. The force exerted and the depth of penetration are recorded automatically on graduated circles, and the combination of these indications gives the degree of hardness. With this apparatus the relative value of various specimens of India rubber can be determined very easily and rapidly.

So large a quantity of copper is required to color canned vegetables thoroughly that the only safe rule is to prohibit the addition of copper salts absolutely. The objection that this prohibition would favor imported canned vegetables, at the expense of the domestic product, should be met by a rigid inspection of imports. The quantity of copper may be determined by incinerating the vegetables, leaching the ash with nitric acid, evaporating to dryness, dissolving the residue in hydrochloric acid, neutralizing the solution with ammonia, acidifying it slightly with hydrochloric acid, and precipitating the copper with zinc in a vessel of platinum.

In 1907 many specimens of Seltzer water were examined by Dr. Klein, who found that most of them contained great numbers of micro-organisms. This result created some surprise, for carbonic acid under pressure was supposed to be fatal to all bacteria. Dr. Klein admits the germicidal power of carbonic acid, but finds that it acts very slowly in Seltzer water, which may contain living bacteria four months after bottling. As a rule, carbonated waters are consumed a few weeks after bottling, and it appears impracticable to demand that they be kept long enough to insure self-sterilization. Consequently, English producers of mineral waters formed an association, which prescribes the precautions required to insure the production of perfectly wholesome waters, and issues certificates to members who adopt those precautions. English bacteriologists find that the waters furnished by these manufacturers are perfectly wholesome, but they remark that the search for absolutely germ-free water is Utopian, for even distilled water becomes infected on the slightest exposure to the air. All that can be exacted is that perfectly pure water shall be employed in the manufacture and that the process shall be so conducted that the bottled water shall contain no more bacteria than the water from which it is made.

The extraordinary vogue of the pictorial postcard has resulted in the evolution of various projecting lantern devices, whereby the pictures resplendent in all their colors may be thrown like a transparent lantern slide upon a sheet. One of the latest and most successful of these has recently been perfected in England under the name of the "Fifax" reflectoroscope. It is an ingenious device, and is intended to dispense with the necessity of preparing special glass slides for lantern projection. In general appearance it resembles the popular magic lantern, but instead of the light being transmitted through the condenser, slide, and lens in a direct line, the image is projected upon the screen by reflection, as its name implies. The picture to be shown is placed at the back of the lantern, where a powerful beam of light of 3,000 candle-power is concentrated upon it by means of two reflectors, and the image is retransmitted therefrom through the lens onto the screen. The feature of this particular apparatus is the lighting system, whereby such an intense, powerful illumination is obtained. Though designed for use with electricity, oxyhydrogen, petroleum, or other lighting mediums, gas is recommended as providing the steadiest and most penetrating beam. The burners are of a special high-pressure type, and fitted with incandescent mantles, and the projection is such that the reflection is as vivid and striking as if a high-grade glass lantern slide were used.. Not only can picture postcards be projected in this manner, but ordinary photographic prints printed by any process, as well as ordinary letterpress printing. It will be realized that the system not only appeals to those who possess no knowledge of photography, but to the amateur in the latter art represents a considerable saving in the preparation of slides. With the high-pressure incandescent gas system the cost of operation averages about half a cent per hour. The picture transmitted can be projected for a considerable distance; but the brilliancy and definition naturally decrease with the distance.

THE BRITISH ARMY AEROPLANE.

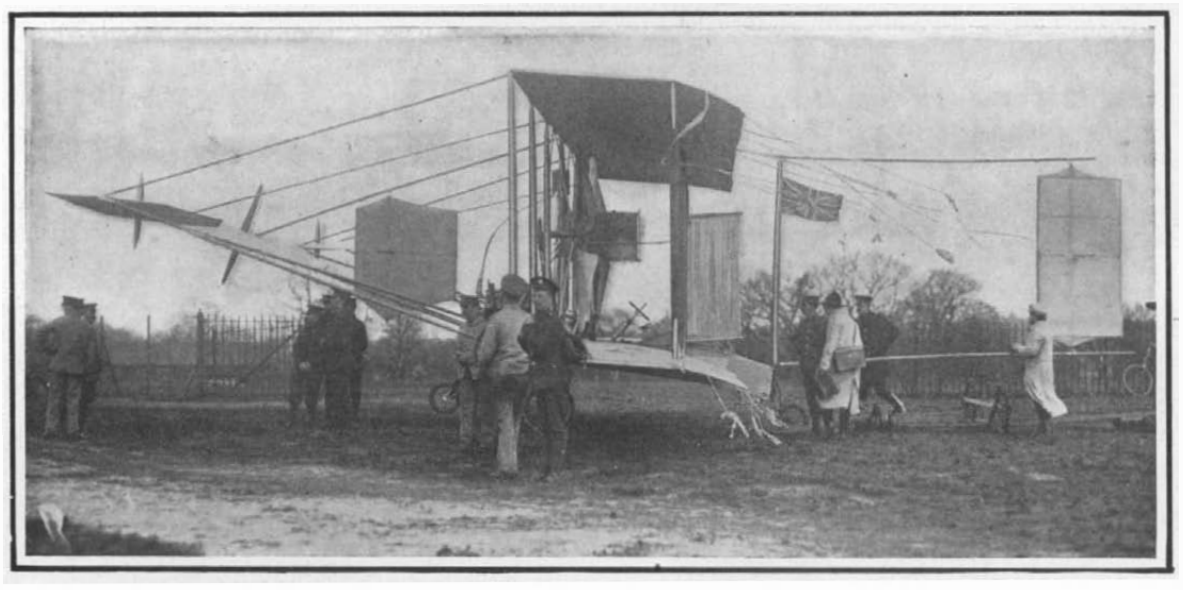
After carrying on a series of experiments last September and October, the aeroplane designed by Capt. S. F. Cody, of the British Aeronautical Corps, was remodeled and has lately been given some further trials.

As first designed, this machine was similar to the present aeroplane. The dimensions of the planes were 40 feet long by 7½ feet wide, and they were spaced 8 feet apart. Movable wing tips were arranged at the ends of the lower planes, the horizontal rudder being placed in front and the triangular vertical rudder at the rear. There was also a small triangular vertical surface above the main plane at the center. The flights made by this machine were 304 feet on September 29, 200 feet at 10 feet elevation on October 14, and 1,200 feet at 30 feet elevation in 27 seconds on October 16. In the last flight the machine tipped to one side and was smashed when it struck the ground.

The planes of the new machine are about one-third longer than those of the old one, and the total weight of the machine is some 1,500 pounds. The same 50-horse-power 8-cylinder Antoinette motor is used. It is placed at the front of the lower plane in the center, and drives two peculiar propellers located each about 4 feet on either side of it at the front edge, by means of chains. The movable wing tips have been placed beside the horizontal rudder, so that they are practically extensions of it. One of these turns upward and the other downward when the steering column is swung from one side to the other, while a forward and backward motion of the steering column turns the horizontal rudder. The vertical rudder is placed at the rear as before, and is worked by turning the steering wheel. The 3-gallon gasoline tank is placed above the motor, and the radiator is located vertically behind the aviator's seat, which is back of the motor. The motor is mounted upon a substantial chassis and strong springs are interposed between this chassis and the axles of the running gear for the purpose of absorbing the shock when the machine strikes the ground.

The most notable feature of this aeroplane is found in the two propellers. These are of a peculiar type similar to that described in the SUPPLEMENT of December 19, 1908, by Mr. Sidney H. Hollands. The peculiar feature is that the blades are broader at their base than at their ends, the width at the base being 24 inches, and the width at the outer end being but 5 inches. The length of the blades is about 3 feet. They are made of aluminium and are curved somewhat like a sugar scoop. Each one is mounted on a strong piece of steel tubing. Mr. Cody, as well as Mr. Hollands, both claim to have found that a blade of this shape gives better results than the usual form of blade, which is narrower at the base than at the tip. It is only in this respect that Mr. Hollands' propeller resembles that used by Mr. Cody on the British army aeroplane. In a letter to English "Aeronautics" Mr. Hollands describes his propeller (with which he claims to have obtained a thrust of 26 pounds per horse-power) as having two "narrow-tipped blades of a special conchoidal (or irregular crescent-shape) cross-section, set to pitch-angles of maximum efficiency. These angles, together with the other foregoing essential features, were all separately determined by a long and careful series of comparative experiments. The blades have a twist, and the pitch is 0.7 of the diameter. It is most efficient at high speeds (the driving torque being relatively very small), and the essential features of the design lend themselves to strength and rigidity. It is constructed wholly of high-grade steel, and the 2 meters diameter type weighs 13 pounds, with a factor of safety of six, at 1,200 revolutions per minute." Mr. Hollands claims that his propeller is superior to those used on the army aeroplane and that it was designed some years before the propellers of Mr. Cody.

According to a cable report, the first test of the remodeled aeroplane occurred on the 20th instant. Two short flights were made by Capt. Cody successfully, but the third one was terminated, after the machine had traveled some 300 feet at a height of about 20 feet from the ground, by the buckling of the horizonal rudder, and the aeroplane fell heavily and was badly wrecked.



End view of the British army aeroplane.

Note the vertical rudders in the front and rear, the propellers and motor at the front edge, and the vertical gasoline tank and radiator between the planes at the center and toward the rear. The flag and streamers show the direction of the wind.

THE NEW AEROPLANE OF THE BRITISH ARMY AERONAUTIC CORPS.

The Meeting of the Society of Automobile Engineers.

On Tuesday of last week the Society of Automobile Engineers held a meeting at the Automobile Club of America in the morning, and in the building of the United Engineering Societies in the afternoon. The opportunity was taken to make some tests upon the dynamometer of the Automobile Club. A Fiat machine was first tested, and at a speed of 40 miles an hour, 20-horse-power was developed at the rear wheels. The Benz racer, which obtained second place at the Grand Prix race at Savannah, was next tested, and on the second speed it attained a road speed of 65 miles an hour with the development of 100 horse-power. During this test the drawbar pull rose as high as 750 pounds. When it is remembered that the machine is fitted with four speeds, it can be seen that when traveling 90 miles an hour this machine must develop well over 100 horse-power.

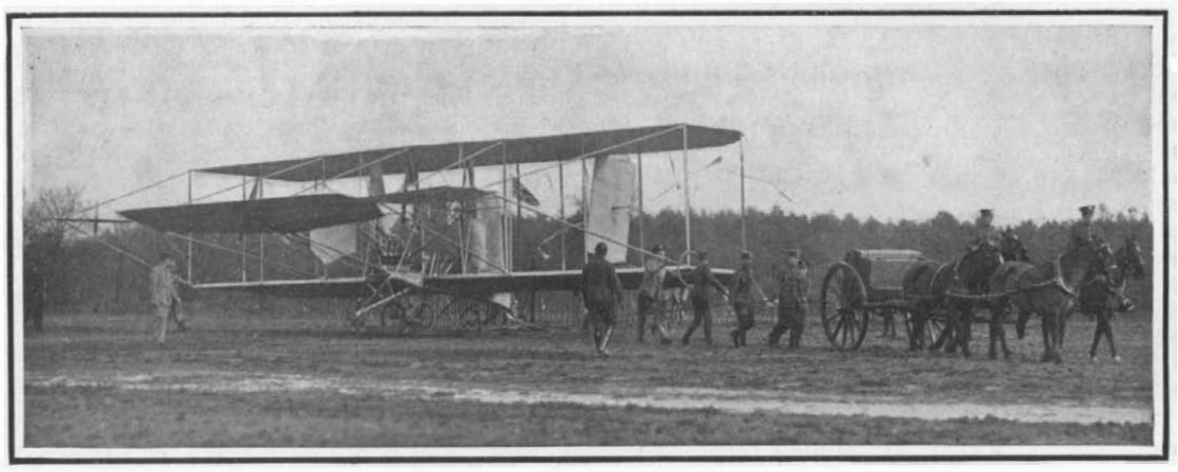
At the afternoon session of the Society several papers were read upon "Autogenous Welding," "Standardizing Motor Bearings," "The Economics of Weight Reduction," and "A New Type of Indicator for Gasoline Engines."

A $500 Prize for a Simple Explanation of the Fourth Dimension.

A friend of the SCIENTIFIC AMERICAN, who desires to remain unknown, has paid into the hands of the publishers the sum of $500, which is to be awarded as a prize for the best popular explanation of the Fourth Dimension, the object being to set forth in an essay the meaning of the term so that the ordinary lay reader can understand it.

Competitors for the prize must comply with the following conditions:

1. No essay must be longer than 2,500 words.
2. The essays must be written as simply, lucidly, and non-technically as possible.
3. Each essay must be typewritten and identified with a pseudonym. The essay must be inclosed in a plain sealed envelope, bearing only the pseudonym. With the essay should be sent a second plain sealed envelope, also labeled with the pseudonym, and containing the name and address of the competitor. Both these envelopes should be sent to "Fourth Dimension Editor, SCIENTIFIC AMERICAN, 361 Broadway, New York, N. Y."



Three-quarter front view of the aeroplane.

The movable tips at each end of the horizontal rudder, the motor and propellers, the three-wheeled chassis with buffer wheel in front, are all visible in this photograph.

4. All essays must be in the office of the SCIENTIFIC AMERICAN by April 1, 1909.
5. The Editor of the SCIENTIFIC AMERICAN will retain the small sealed envelope containing the address of the competitor and forward the essays to the Judges, who will select the prize-winning essay.
6. As soon as the Judges have agreed upon the winning essay, they will notify the Editor, who will open the envelope bearing the proper pseudonym and containing the competitor's true name. The competitor will be notified by the Editor that he has won the prize, and his essay will be published in the SCIENTIFIC AMERICAN.
7. The Editor reserves the right to publish in the columns of the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT three or four of the more meritorious essays, which in the opinion of the judges are worthy of honorable mention.

Prof. Henry B. Manning, of Brown University, and Prof. S. A. Mitchell, of Columbia University, will be the judges.

AERONAUTICAL NOTES.

Wilbur Wright has gone to Pau, in the south of France, where he has been joined by his brother Orville. These two famous aviators expect to spend some time at Pau making flights and conducting experiments. The French company that is selling their machines already has orders for thirty-three in hand.

Glenn H. Curtiss, our only other famous aviator and the first winner of the SCIENTIFIC AMERICAN Trophy, has left for Dr. Bell's home near Baddeck, Nova Scotia, where he will aid the other members of the Aerial Experiment Association in conducting experiments with Dr. Bell's tetrahedral-cell aeroplane (which is to be fitted with a motor and propellers) and also in making further flights with the "Silver Dart." This fourth aeroplane of the A. E. A. has been fitted with runners so that, like the first one, it can be started on the ice. Before starting on his trip, Mr. Curtiss has completed the drawings for a new 4-cylinder, water-cooled aeronautic motor of about 25 horse-power and not more than 100 pounds weight. The first engine of this type will be built at once.

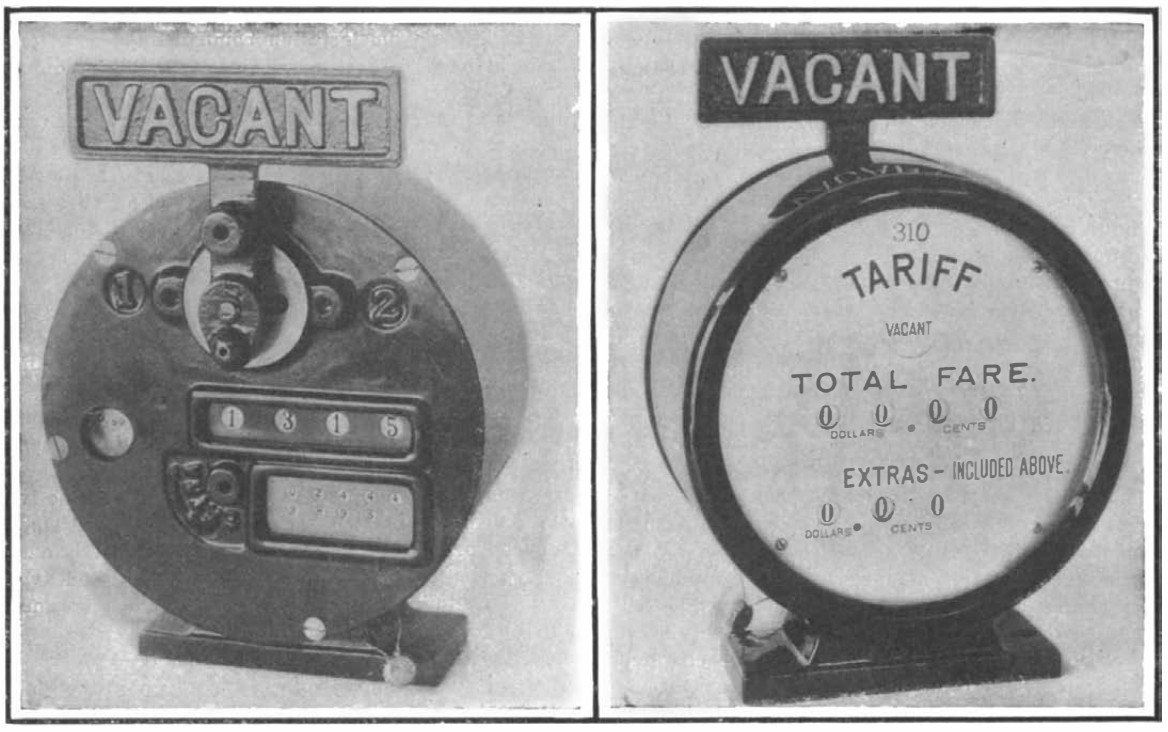
The sheds of the Aeronautic Society at Morris Park now contain two new aeroplanes which are being worked upon daily. These are the 450-pound machine of Frederick Schneider and an aeroplane of nearly double this weight that is being built by W. R. Kimball. Both machines are of the Wright type and both have novel features. The former has a pivoted horizontal surface in the rear above the vertical rudder in addition to the usual front horizontal rudder. An Adams-Farwell revolving-cylinder motor of 36 rated horse-power and but 98 pounds weight drives two 68-inch propellers in opposite directions. A third propeller can be used in the center between the other two if this is found desirable. There are three control wheels for operating the various rudders. Mr. Kimball's machine has a row of eight 4-foot propellers placed between the planes and extending nearly their entire width. These propellers are driven by a wire rope in the same manner as on this experimenter's helicopter, and the same 50-horse-power, two-cycle motor that was used on this machine is to furnish the motive power. This is the first application of multiple propellers—i. e., of more than two or three—to an aeroplane, and it will be interesting to see how this method of propulsion (which is claimed to be more efficient) works out in actual practice.

TAXIMETER FRAUDS.

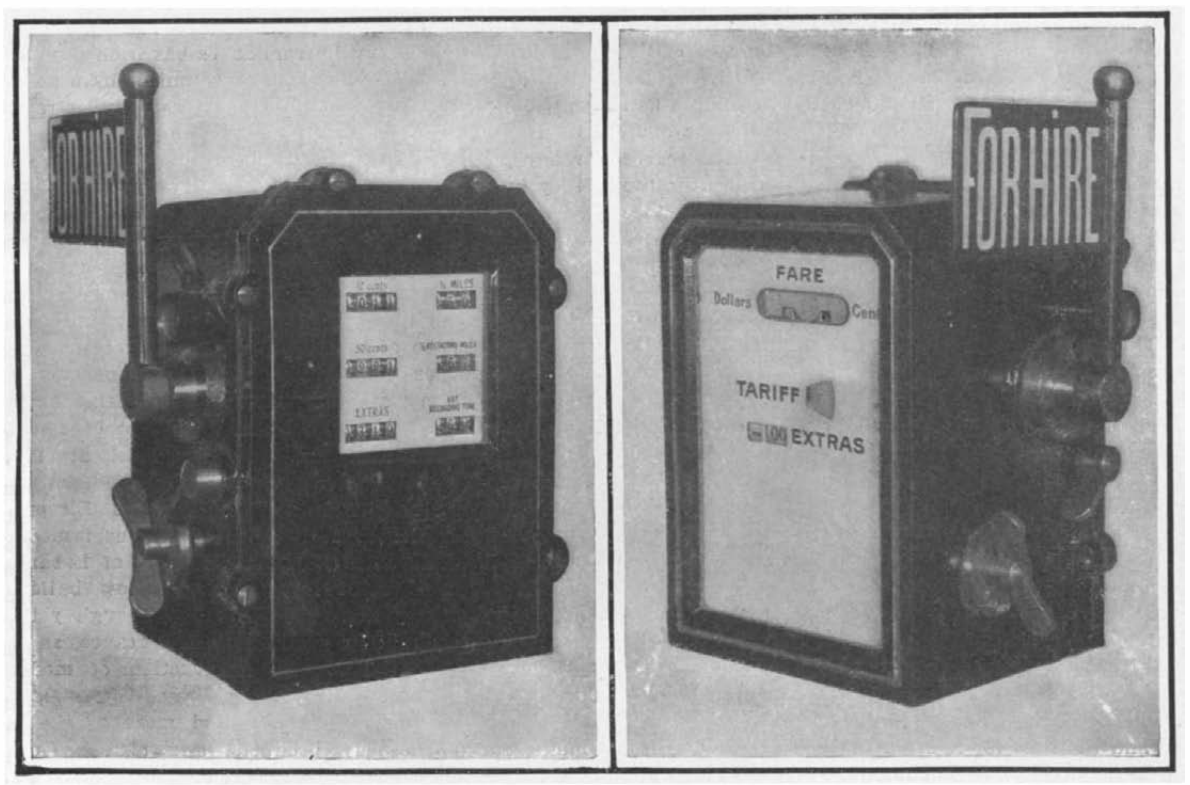
BY ROGER B. WHITMAN.

When the taximeter was first introduced into New York city, the cab-using portion of the population was more or less familiar with its workings through hearsay, and expected at once to receive the benefits that were being derived from its use in the European cities. This was not immediately the case, and the complaints of overcharges were more frequent than with the older system of payment. Even after an experience of two years, it is common to hear complaints made of the service; and it is very generally supposed that it is because the chauffeurs have methods by which they can handle the instrument in such a way as to defraud the public. This was undoubtedly possible when the instruments were first brought out, for it was only to be expected that unscrupulous chauffeurs should attempt to tamper with the mechanism, in order to cause it to register incorrectly. The different methods by which this was done have been learned by the taximeter manufacturers, and step by step they have provided safeguards for the mechanism, until at the present day it is difficult, if not impossible, to derange it without detection.

The claims of overcharge now being made are usually due to the ignorance of the riding public in the reading of the instrument, or in their neglecting to take simple precautions. The mechanism of the taximeter is complicated, but the results as far as the passenger is concerned are simple. In most cases, he will find on the face of the instrument the charge for the mileage covered, or for the time which the vehicle has been kept waiting. A separate dial charges the cost of carrying luggage, and the figures on this are to be added to those on the principal dial to obtain the total charge. In at least one instrument it is necessary to make only a single reading, all charges appearing as one set of figures.



Rear and front views of the Jones taximeter.



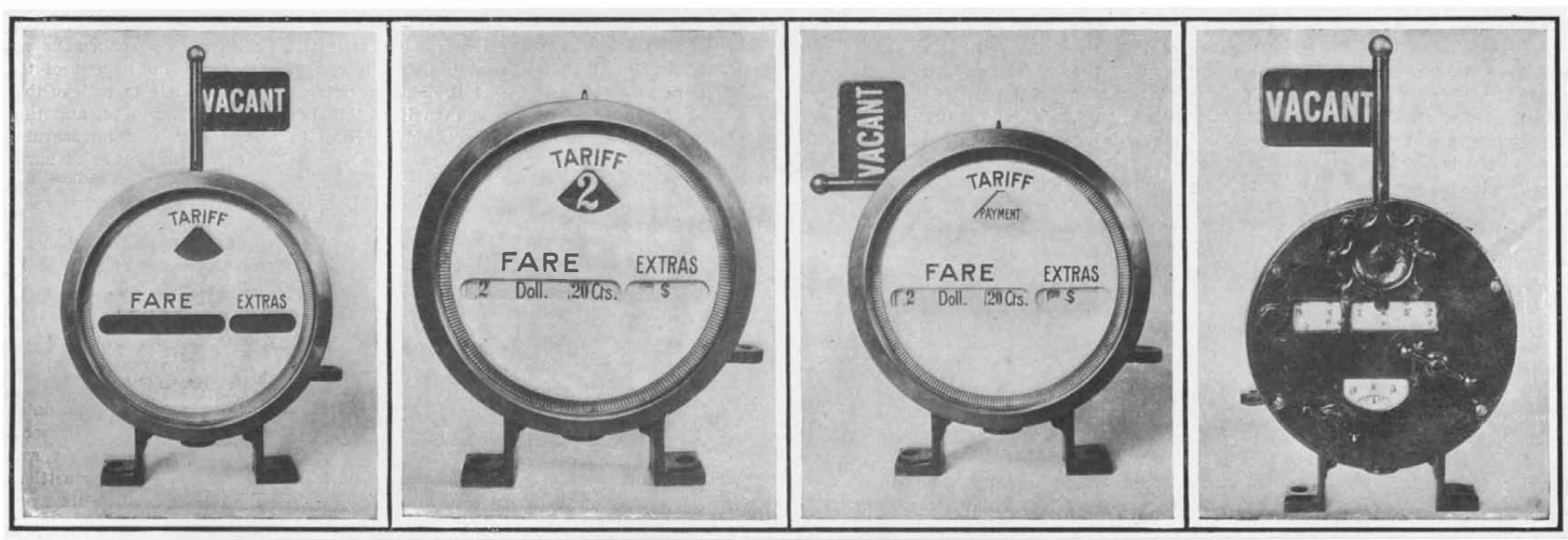
Rear and front views of the Lavalette taximeter.

In order to safeguard himself from an overcharge by an unscrupulous chauffeur, the passenger must have some knowledge of the instrument itself. The mechanism consists of two wheels or disks, one of which is operated by the movement of the car, and the other by a clockwork. One or the other of these two wheels actuates the counting mechanism, that shows the charge against the passenger on the face of the dial. If the car is moving, the wheel driven by the forward movement of the car operates the figures, the wheel actuated by the clock then moving more slowly, and having no effect on the counter. If the passenger halts the vehicle, it is the wheel driven by the clock that operates the counters.

The various makes of taximeters in use in New York city differ somewhat in their action, and familiarity in the reading and possible misuse of one may not protect the passenger who encounters another. In the Kosmos taximeter, the flag has four positions. When in the upright position, the mechanism is thrown out of engagement, and this is used when the car is waiting for a passenger. The flag is attached to a shaft, and when the vehicle is hired, the flag is moved in such a manner as to give the shaft a portion of a revolution, which will cause the figures 1 or 2 to appear on the dial under the word "tariff." With some cab companies, tariff 1 is used for one or two passengers, tariff 2 being employed when three, four, or five passengers are carried. Other cab companies have but one tariff, regardless of the number of passengers.

When hiring a taximeter cab, the passenger should first inquire from the driver under which tariff the taximeter will be operating; and as there are different rates in use in New York city, he should have it made clear whether he will be charged 30 cents or 50 cents for the first half mile. On accepting the passenger, the chauffeur turns the flag, and the charge figures for the first half mile appear on the face of the dial, the passenger being entitled to transportation for that distance. On the completion of the half mile, the charge for the next quarter or half mile is added, the passenger thus being charged in advance. If the passenger requires the cab to wait, the charge for this form of service is added by the clockwork, new figures appearing at the end of every six or ten minutes, according to the tariff.

At the end of a trip, the flag should be thrown to a third position, known as "payment." This will disconnect the recording mechanism from the clock and vehicle wheel, the figures indicating the charge remaining exposed on the dial. This position is provided in order that the passenger may make change without having the total fare altered by the action of the clock. When the fare is paid and the transaction completed, the flag is moved to the "vacant" position,



The flag of the Kosmos taximeter has four positions. There are two tariffs. The passenger should note the position of the flag and the tariff number.

and the figures on the dial then become obscured.

The flag on the Franco-American taximeter has but two positions, the "vacant" and the "recording." The number of the tariff to be used is operated by a key or lever, as is also the "non-recording" device.

The flag shaft on the Jones instrument makes a revolution for each transaction, passing successively through the positions of "tariff 1," "non-recording," and "tariff 2" to the "vacant." In these two instruments the "non-recording" position is used while the passenger is paying the fare, and also when the car is held up by a traffic block, a mechanical derangement, or other cause for which the passenger should not legitimately be charged.

The unscrupulous chauffeur can profit by the ignorance or inattention of the passenger. One passenger having been discharged, and another immediately hailing the cab, the chauffeur may not throw the flag from the "non-recording" position to the "vacant" and then to the "tariff" position, as he should do, but on some makes of taximeters can move it from "non-recording" backward to "tariff." If the passenger does not notice this, at the end of his trip he will be required to pay the sum shown on the taximeter, which includes the charge of the previous passenger as well as his own. This is particularly likely to be the case where the first passenger had only a short ride, the chauffeur being reasonably certain that the second passenger will not quibble over a matter of 30 to 60 cents. Again, with any make, at the end of the trip the chauffeur may move the flag from the "tariff" position through the "non-recording" to the "vacant" without stopping. The figures will thus disappear from the face of the instrument before the passenger has had time to read them, so he must take the chauffeur's word as to the charge.

If the passenger will assure himself of the correct position of the flag, and will insist on reading the taximeter before making his payment, he will protect himself against an overcharge.

The taximeter is actuated by means of a flexible cable driven by a star wheel that is operated by the rotation of one of the vehicle wheels. The connection between the star wheel and the vehicle wheel may be by spur gears, or by a spiral of 1⅛ turns attached to the spokes of the driving wheel. With taximeters operating by a spiral, it is possible in some cases to bend this in such a manner that it engages two teeth of the star wheel where it should engage but one, the taximeter then registering double.

An accurate operation of the taximeter cannot be secured when it is driven by one of the driving wheels of the car. The driving wheels are controlled by the engine, and if running on a slippery pavement, they may revolve more than once where the front wheels, which are actuated by the forward movement of the car, would make but one revolution. If a chauffeur runs his car with the taximeter-controlling wheel on a slippery portion of the pavement while the other driving wheel has good traction, a far greater mileage will be recorded by the instrument than should justly be the case. It is quite usual to see taxicabs operating on slippery days with a non-skid device on the wheel that is not operating the taximeter. The action of the differential, due to the difference in the traction of the two driving wheels, will then cause the taximeter to register a far greater mileage than is legitimate. The profit due to this comes only in part to the chauffeur, for he usually gets a percentage of the day's takings. It is the company operating the taxicabs that will receive the greatest benefit from an arrangement of this sort. In certain European cities it is against the law to operate taximeters by one of the driving wheels of the vehicle, and this is undoubtedly a great protection to the traveling public.

The taximeter itself is protected by lead seals, which must be broken in order that access may be gained to any part of the mechanism. Because of this, the chauffeur does not attempt to dismount any of the mechanism; and even should he disconnect the star wheel, so that the instrument will not register at all, the discrepancy between the normal mileage of his car and the reduced mileage shown by the instrument as a result of his act, would lead to his prompt detection.

It is possible for the chauffeur to defraud the company by carrying passengers while the taximeter flag is in the "vacant" position, collecting from them what they are willing to pay, and explaining the extra mileage shown by the instrument as having been required in returning from some distant point after the discharge of a passenger. He can also run with the flag in the "non-recording" or "payment" position, when no corresponding charge will appear on the instrument; but as the taximeter clockwork records for the benefit of the company the minutes during which the flag is in this position, an excess would lead to his detection.

In London, all taximeters are under the strict supervision of the police department; and not only must each make be passed upon, but every instrument must be tested and stamped before it can be put into service. In Paris, as well as in London, the police have the authority to stop any taxicab for the purpose of inspecting the instrument and receiving assurance of its correct operation, and can also arrest any chauffeur whose flag is not in the proper position for the number of passengers he is carrying.

The large transportation companies operating taxicabs in New York city are sincere in their endeavors to protect their patrons from overcharges, and inquire into all complaints. They state that a considerable proportion of the complaints made to them are due to the carelessness of the passenger in not noticing the position of the flag or in neglecting to read the instrument, and in unfamiliarity with its operation. In going to a point exactly one mile distant from the starting point, for example, the direct run would record a charge of 50 cents; but if traffic conditions required the driver to go even slightly out of the way, the instrument would record 60 cents. The taximeter measures the distance in units of one-quarter of a mile, and makes its charge in advance. A recognition of this fact would remove one cause of discussion between passenger and chauffeur.

When a knowledge of the taximeter is instinctive in the traveling public, the chauffeur will not attempt to mislead or to overcharge; but until then it is only to be expected that unscrupulous drivers will endeavor to add to their incomes by imposing on the ignorance or credulity of their passengers.

CLAY PRODUCTS OF THE UNITED STATES.

Bricks have been found as old as 4000 B. C., so that their use is coeval with the birth of history. In the Middle Ages, with the rise of Gothic architecture the use of brick greatly declined. It was not until the reign of Queen Elizabeth that the manufacture again flourished in England, and it was not until 1625 that bricks began to be made of uniform size.

In this country brick were probably first burned in the colony of Virginia as early as 1612, says Charles E. Hall in an interesting Bulletin of the Bureau of the Census. In New England brick and tile making seems to have been followed as an independent calling about the year 1647. Though the product was of good quality the industry did not thrive, as money was scarce and timber plentiful, and it was not until after the revolutionary war that home-made bricks came into general use. With increasing prosperity the desire and necessity for more substantial structures arose. The growth of the industry from year to year naturally provided a stimulus for the invention of machinery that would produce better brick, new shapes, and different sizes; and in turn these new inventions contributed to further the growth of the industry. The earliest record of a patent issued by the United States Patent Office for brickmaking is dated May 15, 1800, and was for a brick and tile machine invented by G. Hadfield, residence not recorded. Other patents issued about that time were one to E. Miller, July 17, 1802, for a brick machine; one to N. and P. W. Miller, January 5, 1804, for a brick and tile machine; one to W. Hodgson, Richmond, Va., May 22, 1805, for an apparatus for making tile, brick, etc.; and one to J. F. Gould, Newburyport, Mass., March 1, 1806, for a brick machine. The first patent granted for a brick-kiln was issued to H. Read, of Kensington, Pa., June 17, 1840; and the first for a brick dryer, to S. M. Parish, of Baldwinsville, N. Y., August 16, 1864.

Although much the same process for making brick and tile has been used for ages, the evolution of the industry through the use of improved methods and machinery has brought about a great change in the character of the product. It is a long stride from the use of hand pick and shovel to steam shovel in uncovering the clay bed; from the old-fashioned ring pit to the machine that grinds, tempers, and molds; from the use of a hand mold to the machine with a capacity of 100,000 bricks per day; from the open air system, or a weather beaten drying shed, to the utilization of artificial heat for drying; from the temporary to the patented continuous kilns; and from the poorly made product of years ago to the firm, straight-edged, and otherwise well finished product of to-day. Of the $119,956,959 capital invested in this industry, the machinery, tools, and implements represent $33,295,324, or 27.8 per cent, an increase in five years of $16,045,486, or 93 per cent.

Common Brick.—Enormous quantities of common brick are manufactured in all sections of the country. Surface clays are generally used, and more attention is given to the volume than to the color and general qualities of the product, as the price is low and the brick used mostly in ordinary wall construction and foundation work.

Sand-lime Brick.—The sand-lime brick industry has passed the experimental stage, and though still in its infancy there is every reason to believe that it will eventually rank among the foremost of the country. The successful manufacture of sand-lime brick in foreign countries appears to antedate that in this country by several years. According to United States Consul-General Mason, at Berlin, the discovery that freshly pressed bricks of sand and lime could be hardened in a few hours by heat and pressure of steam was made in Potsdam, Germany, about 1880. Plants on a large scale were subsequently constructed, and the industry extended throughout Germany and Great Britain. In the United States the industry has grown from one plant, established in Michigan City, Ind., in 1901, to fifty establishments in 1905. In some instances these brick were made in establishments having clay products as their chief output, while in others they were products of plants exclusively confined to the manufacture of sand-lime brick.

Red Front Brick.—In the production of red front brick great care is exercised in the selection of raw materials and in the process of manufacture. The clay must be well tempered; the brick molded free from flaws or sand cracks; the method of drying be more complete than for common brick; and the repressing and subsequent drying, setting in kiln, and burning, skillfully and systematically managed. This additional attention necessarily increases the cost of production. Every State reported the manufacture of red front brick except Florida, Nevada, South Dakota, Vermont, Wyoming, and the Territory of Arizona. The State of Pennsylvania ranks first in value of product, New Jersey second.

Fancy and Ornamental Brick.—Fancy colored and ornamental brick are primarily pressed brick. The different shades of color in the former are produced by the addition of artificial materials or by the manipulation of the kiln fires, while the distinguishing feature of ornamental bricks are the designs in relief or in intaglio upon the surface to be exposed.

Fire Brick.—As the name implies, fire brick are used where intense heat must be withstood, as in cupolas, blast and glass furnaces, coke ovens, locomotive fire boxes, etc. The utility of the appliances just mentioned depends largely, it not altogether, on construction out of materials which will stand intense heat without fusing, cracking, or yielding in any way.

A new fire brick made from ashes has been produced by a Michigan firm. The ashes are united by a powerful binder, molded, and the product conveyed straight to the drying room. It is claimed that the brick are ready for laying five days after manufacture; that they have been tested in fire and water with satisfactory results; and, further, that the product is two-fifths lighter than terra cotta, and yet stands considerable crushing force.

Enameled Brick.—These bricks are ornamental, and in addition to being used for external decoration in the construction of buildings, are extensively used for sanitary purposes, their glazed and vitreous surfaces rendering them waterproof and easy to clean. As the surface of the brick to be enameled must be smooth and free from sand, pressed and fire brick are most often used.

Hollow Building Tile and Blocks, and Fireproof Brick.—On December 9, 1856, a patent was issued to M. and J. H. Buck and F. A. Cushman, of Lebanon, N. H., for a machine for pressing hollow building brick or building tile. This industry, though yet in its infancy, is rapidly growing in importance, as the product is essential to the construction of modern fireproof buildings.

Possibly nothing has contributed more to the demand for burnt clay products, and brought more clearly to the attention of the public their value as a fire retardant, than the recent great fires in Baltimore, Rochester, and San Francisco. Without considering, however, these occasional catastrophes, it is estimated that the United States yearly sustains a fire loss of $250,000,000, a sum almost double the combined value of all clay products manufactured in this country during the same time and nearly three times the total value of all the brick, fireproofing, terra cotta, lumber, hollow building blocks or tile, and roofing, floor, and encaustic tile. With such an enormous annual property loss, and with the thinning out of the forests of the country, it is reasonable to believe that a change in building methods is imminent, and that the new era of construction will be of immeasurable benefit to those engaged in the manufacture of burnt clay building materials.

It is claimed that the annual fire loss in this country during the past five years amounted to about $2.50 per capita, as against only 33 cents per capita in the larger European countries. This unsatisfactory showing for the United States has resulted in a growing demand for a fireproof brick that can be used in the construction of moderate-priced dwellings, and several large plants are now making a specialty of such an article.

Drain Tile.—The manufacture of drain tile also dates back to early ages, and many instances of its general use by the ancients have been found. That it was used, probably in a crude form, by the early settlers of this country can not be doubted, as patents were issued for its improved manufacture in the year 1800.

Pottery.—It is recorded that a white ware was produced at a pottery erected in Burlington, N. J., in 1685 by the American agents of Dr. Daniel Coxe, of

London. However, it is not likely that the ware made at this pottery was white, general opinion being that it was yellow and cream colored, as at that time no other ware was known except the porcelain which came from China, and was known as "China ware." Ordinary household pottery and ornamental vases for flowers were made in West Whiteland, Chester County, Pa., as early as 1753; a pottery and glass works was in operation in Germantown, New Quincy, Mass., in 1760; and a pottery in South Carolina in 1765. Cream colored ware, both plain and decorated in blue, was made in Philadelphia in 1770.

It appears, however, that the potteries established before the revolutionary war did not meet with marked success, and that this industry, like the manufacture of brick, did not assume commercial importance until after that war, when a period of new economic and industrial life began. About this time many enterprises were launched, including a number of potteries.

Our first page engraving shows a graphical comparison of the magnitude of clay products for one year. The pyramid would be 4,294 feet high and looms well up toward the summit of Mount Washington.

The total value of the products of clay in the United States in 1907 was $158,942,369. It was divided up as follows:

	Quantity.	Value.
Common brick	9,795,698,000	$58,785,461
Vitrified paving brick	876,245,000	9,654,282
Front brick	585,943,000	7,329,360
Ornamental brick		361,243
Enameled brick		918,173
Fire brick		14,946,045
Stove lining		627,647
Drain tile		6,864,162
Sewer pipe		11,482,845
Architectural terra cotta		6,026,977
Fireproofing		3,162,453
Hollow building tile or blocks		1,088,165
Tile, not drain		4,551,881
Miscellaneous		3,000,201
Pottery		30,143,474

Correspondence.

POE AS A SCIENTIFIC WRITER.

To the Editor of the SCIENTIFIC AMERICAN:

At this writing the University of Virginia is celebrating the one-hundredth anniversary of the birth of America's great poet and author, Edgar Allan Poe. It may not be generally known to those interested in scientific subjects, aviation, etc., that the immortal composer of the "Raven," originator of the short story, and the first great exponent of the science of deduction and unraveler of intricate ciphers and cryptograms, cherished an ambition, according to his biographer, to shine as a scientific writer. Among his miscellaneous writings there is a descriptive article on the flying machines of Henson and Stringfellow, the originators of the single and superposed fixed surfaces, or aeroplane, as it is known, and whose labors at that time (1845) were the sensation of Europe. Henson and Stringfellow constructed and tested a number of model aeroplanes of various shapes and designs; what they conceived to be the best one was fitted with the marvelously light steam engine constructed by Stringfellow (now at the Smithsonian Institution, Washington) and forms the subject of Poe's article, written in the flawless style peculiar to him, employing terms in the description of the model that are new, and doubtless were the invention of his own fertile brain.

J. C. PRESS.

South Norwalk, Conn., January 20, 1909.

AUTOMATIC BLOCK SIGNALS.

To the Editor of the SCIENTIFIC AMERICAN:

I do not agree with Mr. Fagan, who says automatic signals are in any way responsible for railroad accidents. The Boston Elevated Railroad is thoroughly equipped with an automatic block system, installed in such a manner that an accident from a rear-end collision is impossible. A train disregarding one of these signals, at danger, is brought to an immediate stop by an air tripping device. This is much better than any system of rigid discipline of employees. A signal system has come under my notice, which will eventually, I believe, be universally used on all railroads in the United States. It is a system of electric semaphores, centrally controlled, and by pressing a button from the central office, it will set the signal at danger at any desired point on the road. This signal, equipped with a telephone in a box, is located at the base of the pole. As each conductor carries a receiver in his pocket, the train crew is in a position to communicate with the central, or dispatcher's office, and find out why any particular signal was at danger. These signals would be so arranged (as all automatic signals are at the present time) as to show danger in case the signal was out of order; and the train crew would communicate with the dispatcher before proceeding. With this system a dispatcher could *block* trains for a whole division. Of course, he would have to receive prompt "O. S." from stations along the line. The advantages of this system would be a saving in interlocking apparatus and the doing away with a great many block towers (but not switch towers). It is also superior to the automatic block system, in my opinion, for this reason: That trains are under central control, and in case of a train disregarding a signal, an indicator located in the dispatcher's office would show what signal had been disregarded. This is the case in the Boston Elevated Railway's dispatcher's office.

F. H. SIDNEY.

Signal Dept., B. & M. Railroad Terminal Division, Wakefield, Mass., January 12, 1909.

THE MEAT INDUSTRY OF AMERICA.—II.

The reader of this article will be surprised to learn that from fifty-six to fifty-eight per cent only of the animal, as purchased on the hoof, is available for the table. In the early days of the meat industry, the other forty-two to forty-four per cent was regarded as useless and allowed to go to waste. To-day, however, there is practically no part of the animal that is not turned to some useful account. It is claimed, indeed, that the profit of the packing houses is now almost exclusively made out of the by-products.

The hides are carefully stripped by a workman, especially trained to the task, who is careful not to spoil the hide by the slightest slip of his knife. After they have been inspected, they are graded, according to their quality, salted, and stored, and finally sold to the tanneries. The various fats from the animals are worked up into tallow, and the finer qualities, known as butter fats, are used in the manufacture of oleomargarine or butterine, for which by-product Swift & Co.'s plant has a capacity of fifteen tons a day. From the beef suet is made the by-product known as stearine, which is used in large quantities by the tanners and the candle manufacturers. From the seven thousand skins of the sheep, which are killed in this establishment every day, there is gathered daily about ten tons of wool. The lean meat trimmings are passed through a process of preparation, from which they emerge as a good quality of sausages. Horns and hoofs, which at one time were thrown away, now find a ready market. Packing-house refuse is used extensively, also, in the great fertilizer industry. The viscera, immediately upon their separation, are passed down a chute into a lower room, where, after going through certain processes of cleansing and chemical treatment, they are made to render their tribute of useful product, the fibrous matter being dried and ground up for fertilizing material. The bones are worked up into glue and phosphate, the latter being ultimately made into fertilizing material by mixing it with the nitrogenous matter of the fibrous residue, above mentioned, and of the blood.

A most important part of the work of the government inspector consists in looking after the sanitary conditions of the various floors or rooms throughout the building, and the personal cleanliness of the large army of employees. The workmen are required to keep their working clothes clean, or as clean as the conditions of work of this character will admit. Those that handle the meat must wash their hands at stated intervals, lavatories with running water and the necessary appliances being provided for this purpose. If an inspector sees a workman with clothing that is unnecessarily soiled, he orders him to at once change to another suit. For the disinfection and cleansing of the cleavers, scrapers, knives, saws, and other tools, vats of boiling water are provided in close contiguity to the rail and the working benches; and, in cases where defective animals have been detected, the inspector orders the butchers, before they proceed to another department, to at once cleanse their hands in a disinfectant solution of bichloride of mercury; he sees, also, that all tools and implements are similarly cleansed and disinfected. Sheet-iron clothes lockers are provided for the clothes of the workmen, with sheet-iron partitions between the compartments, and perforated sheet-iron doors in front to insure a free circulation of air.

Having now described in detail the various processes in the preparation of refrigerated meat for the market, we will proceed to describe the other great system of meat preservation known as curing, as carried out in the cutting up, pickling, salting, and smoking of ham and bacon. The hogs are driven from the stockyard pens, where they have already undergone a government inspection, to the dressing floor, which has a capacity of 1,000 hogs an hour, or 10,000 per day. They are driven, a few at a time, into a pen, on one side of which revolves a large hoisting wheel with short lengths of chain attached by means of hooks to its outer rim. In the pen are two boys, who quickly loop the chain around the hind legs of the hog. As the wheel revolves, it lifts the animals, one by one, to the top of the wheel, at which point the chains are automatically transferred to an inclined rail. Here the porker passes an operator, who swiftly dispatches it with a deft knife thrust; and after a short interval it is automatically released into a huge vat of scalding water of a temperature of 150 deg. F., where it remains for five minutes. The effect of the hot water is to loosen the hair and scurf and clean the hide. It is then taken from the tank and drawn up through a vertical cylindrical scraping machine, which is full of downwardly-projecting steel scrapers, which are pressed by springs against the body of the animal as it passes through, and take off in a few seconds time nearly all of the hair. It then passes to the scraping bench, where such portions of the hair as have not been removed by the machine are taken off by hand. The bench is arranged as a traveling table, and the hogs, laid across it side by side, travel slowly past the line of operators. When the animal reaches the end of the bench, the operation of dressing is begun. Here the first government inspector examines the glands of the throat, feeling some and cutting into others in order to be sure that the animals are perfectly healthy. The animal is then held in front of what is known as the polishing machine, which consists of a rotating shaft provided with a number of flexible arms made of heavy belt leather, each arm being shod at its end with a steel strap. As the shaft revolves, the animal is pressed against the rotating arm and is strongly beaten and scraped. It is then subjected to a steam jet blast, after which it is hung on the shaving rail, where the last of the hair is removed by hand. This finishes the cleaning; and at this point government inspector No. 2 looks for and identifies the pass mark of inspector No. 1, and places a tag upon the animal.

The animal is now ready for cutting up, and this work is done by an army of skilled workers, each one of whom, as the animals, traveling at the rate of about thirty feet a minute in a continual procession, pass before him down the overhead rail, performs his particular part of the operation with really marvelous speed and dexterity. The viscera are placed in a trough, whence, after they have been carefully examined by a government inspector, they pass to a room where they are separated and sorted, and subsequently manufactured into various by-products. The stomach, after the grease has been extracted, is made into fertilizers; the liver and heart are sold as food products, and the intestines are cleaned and made into sausage casings. The leaf lard (the fat which grows on the inside of the body) is taken out, and subsequently worked into kettle-rendered lard or neutral lard, the kettle-rendered lard being the ordinary lard of household use, and neutral lard being used in the manufacture of butterine. The animal, after being split in two along the vertebræ, finally reaches the end of the rail, where it passes before the fourth government inspector, who examines the inside of the pleural region as a final assurance of perfect health, and also examines the glands near the base of the backbone. The next journey is to the hanging floor, where the sides are sorted according to weight and quality, and are partially cooled by being allowed to hang in a draft of air for a period of a few hours. From the hanging floor the sides are carried into the chill room, a huge refrigerator capable of accommodating many thousand sides. Here they are kept for forty-eight hours at a temperature of 32 deg.

From the chill room the sides are taken to the cutting room, where the shoulders are chopped off, the hams removed, and the feet are cut from the hams by band saws. The bacon pieces are put through rolls to flatten them out into a suitable shape for salting and packing. All the portions of the meat, as thus cut up, are carefully trimmed, and the trimmings are sent down a chute to a room below, where they are retrimmed, the lean portions being subsequently made up into sausage meat, and the fat portions into lard. In the cutting room the "fresh-meat portions" are wrapped in paraffine paper, and packed in boxes and barrels for immediate shipment to the retail butchers. After the meat has been trimmed and cut up, it is sent down a chute into the grading room, where each ham, shoulder, or side is weighed and sorted according to its weight and quality.

It is probable that there is no feature of the meat industry, at least as carried on under modern conditions in the largest establishments, regarding which there has been more popular misconception than that of the curing of meat. While it is undoubtedly a fact that some meat, prepared by obscure and small dealers, occasionally may be subjected to treatment that renders it undesirable, we believe that the system of curing, as carried out by the large establishments under the regulation of federal laws, is perfectly wholesome, and absolutely insures the use of only such ingredients as are healthful.

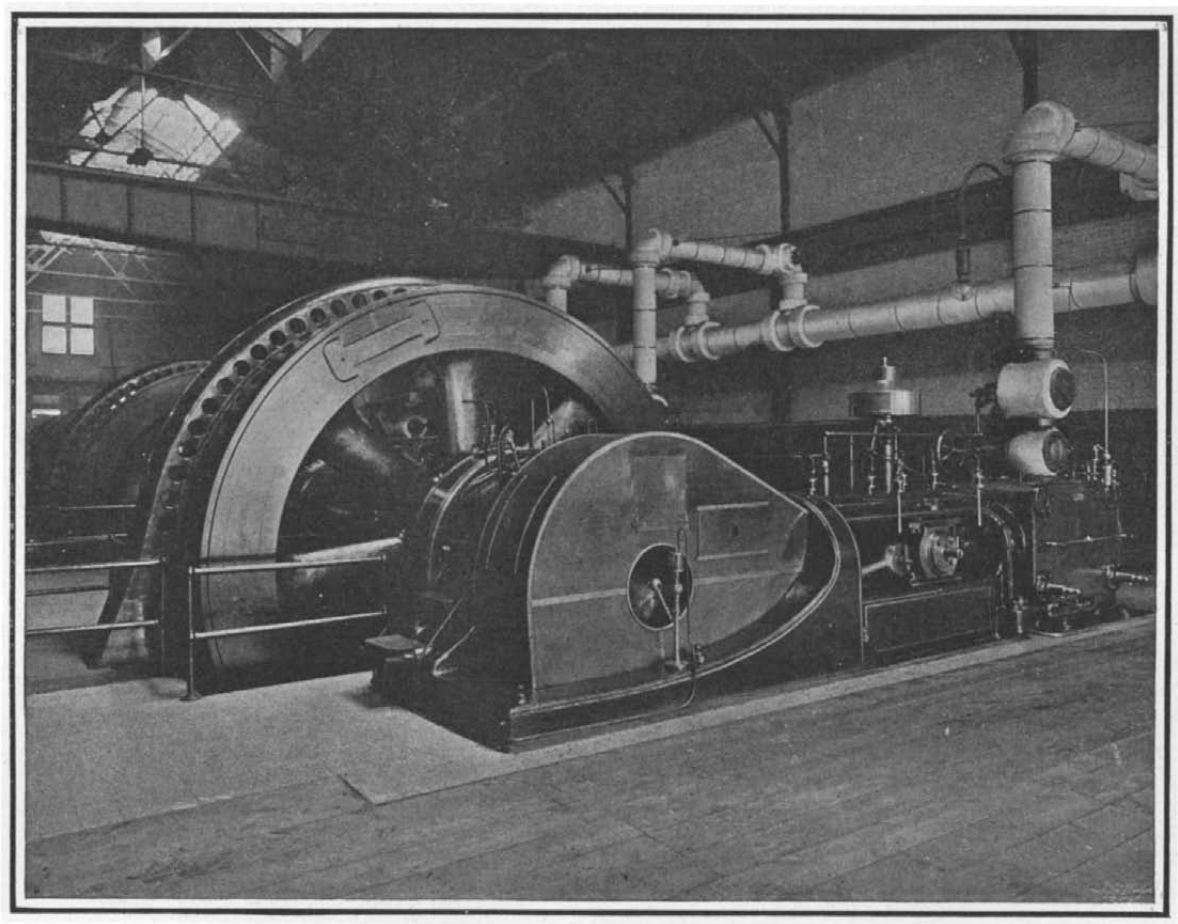
As a matter of fact, the constituents of the solution or pickle used in curing meat, viz., salt, saltpeter, and sugar, are the same that have been used by the farmer, the butcher, and the housewife from time immemorial; and it is certainly remarkable that, in spite of the fact that the problem of meat preservation has been made the subject of thorough laboratory investigation for a long period of years, the chemists have been able to find nothing which gives more satisfactory results than the time-honored preservatives of our forefathers.

The supervision of the federal government of the curing of meats is carried on with the same thoroughness to which we have drawn attention in our description of the preservation of meats by the method of refrigeration. Salt, saltpeter, sugar, vinegar, and wood smoke are specified by law as the only preservatives that may be used. Borax, of which so much has been heard lately, is expressly prohibited except in the case of meats put up for export in accordance with the directions of a foreign purchaser. In this case borax may be used, provided it is not prohibited by the country to which the meat is to be sent. England

makes no objection to the use of borax, and meats sent to England may be preserved in this substance; but they must be prepared in separate rooms, and marked with special labels showing that they are for export only. The greatest care also is taken by the large packing houses in the preparation of the pickle. Swift & Co. maintain an extensive chemical laboratory, which gives steady employment to a corps of ten chemists and bacteriologists, a considerable portion of whose time is taken up with the analysis of the ingredients used in the curing department, and the investigation of the meats at the various stages of the curing.

The size and completeness of this laboratory, and the high technical qualifications of its staff, it may be remarked in passing, bear testimony to the universal sway which chemistry holds over the modern industrial arts. In the investigation of meats, such, for instance, as cured hams, a section several inches square is cut right through the body of the ham, divided into four equal portions, and separate analysis made of each portion to determine the amount of pickle in the different sections, and ascertain if the ham is uniformly cured. The section of meat is hashed, and the ingredients extracted by boiling, the dry residue being dissolved with water and further treated with chemicals.

Samples of the various fertilizers produced in the plants are taken regularly to the laboratory, where an analysis is made to determine the amount of nitrogen, phosphoric acid, and potash which they contain. Tests are also made of the fat, oils, and soap to determine their value. Samples are taken of the materials during the progress of manufacture, in order to insure correct processes and suggest improved methods of treatment. The investigation of frozen meat is carried on along four lines, chemical, bacteriological, histological (concerned with the tissues), and practical. As showing the preservative action of refrigeration, it may be mentioned that in an investigation recently made to determine if there was any deterioration under frozen conditions, samples of frozen meat were placed in the same box with plates of gelatine, and kept there for a lengthy period, without any cultures developing upon the gelatine.



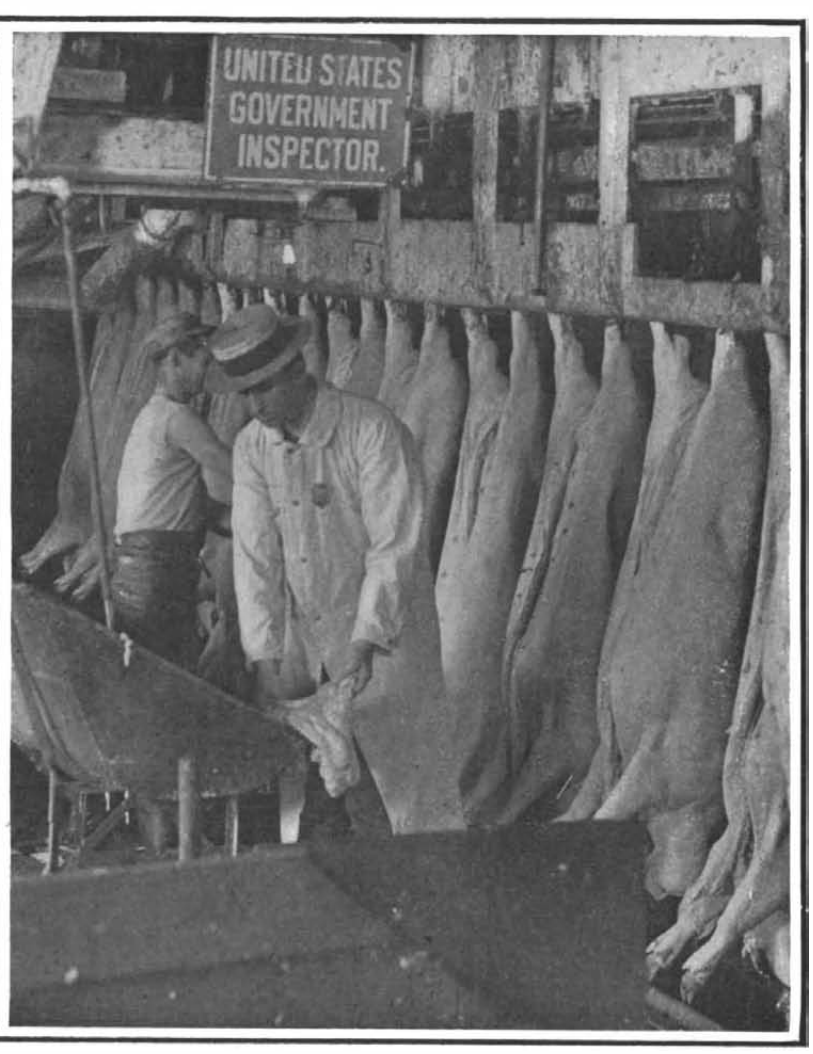
One of the electric generators in the central power station.

The "pickle" is prepared in a plant which the company has devised with a view to insuring absolute cleanliness and adherence to formula. After the solution has been made in the proper proportion, it is thoroughly boiled with a view to its sterilization, then chilled to the desired temperature, and piped to a series of closed tanks. The object of the pickling is to put the meat in such a condition that it will remain sound and sweet. The hams, shoulders, and sides are loaded into vats, which are then entirely filled with the pickle. They are left here for a period of from forty to seventy-five days, during which time, by a process of diffusion, the curing materials are distributed evenly throughout the substance of the meat. It will be understood, of course, that outside of its preservative effect, the process of curing is intended to give to the meat the characteristic flavor which distinguishes it from fresh meat; and no small part of the skill in curing consists in securing the desired flavor by careful work in the pickling and in the subsequent smoking.

In the process of dry curing, the meat is simply rubbed thoroughly with a mixture of dry salt, sugar, and saltpeter, and packed carefully in boxes, in which it remains for a period of thirty days. The juices of the meat supply the necessary solvent, and the process of diffusion gradually takes place, as in the case of meats cured in liquid pickle. After the curing is completed, the meat is inspected by the government official and branded for shipment. The cured meat which is to be further treated by the process of smoking, is taken to the smoke house, where it is carefully looked over, put into vats, and covered with fresh water, in which it is left for half a day to remove the surplus salt and put it into condition for smoking. It is next washed and thoroughly scrubbed in hot water, and then hung on racks mounted on trucks and wheeled into the smoke houses. These are large, square shafts, several stories in height, provided with gridiron floors to permit of the free circulation of the smoke. At the base of the houses slow wood fires of hickory or maple are kept steadily burning for a period of thirty-six hours. The smoking of the meat serves the double purpose of improving the flavor and acting upon it with a strongly antiseptic or preservative effect, the creosote of the smoke being one of the most powerful bactericidal agents in existence. The smoke not only penetrates the substance of the meat, but it forms an outer envelope, which in itself is an effective factor in the preservation of the meat. It should be mentioned

The solution of salt, sugar, and saltpeter is injected to the bone to insure that the impregnation of the meat shall be very thorough.

Injecting salt and sugar pickle into the center of the hams.



These inspectors, who are qualified veterinary surgeons, are stationed at various points in the process of cutting up the meat, which undergoes a most rigid inspection.

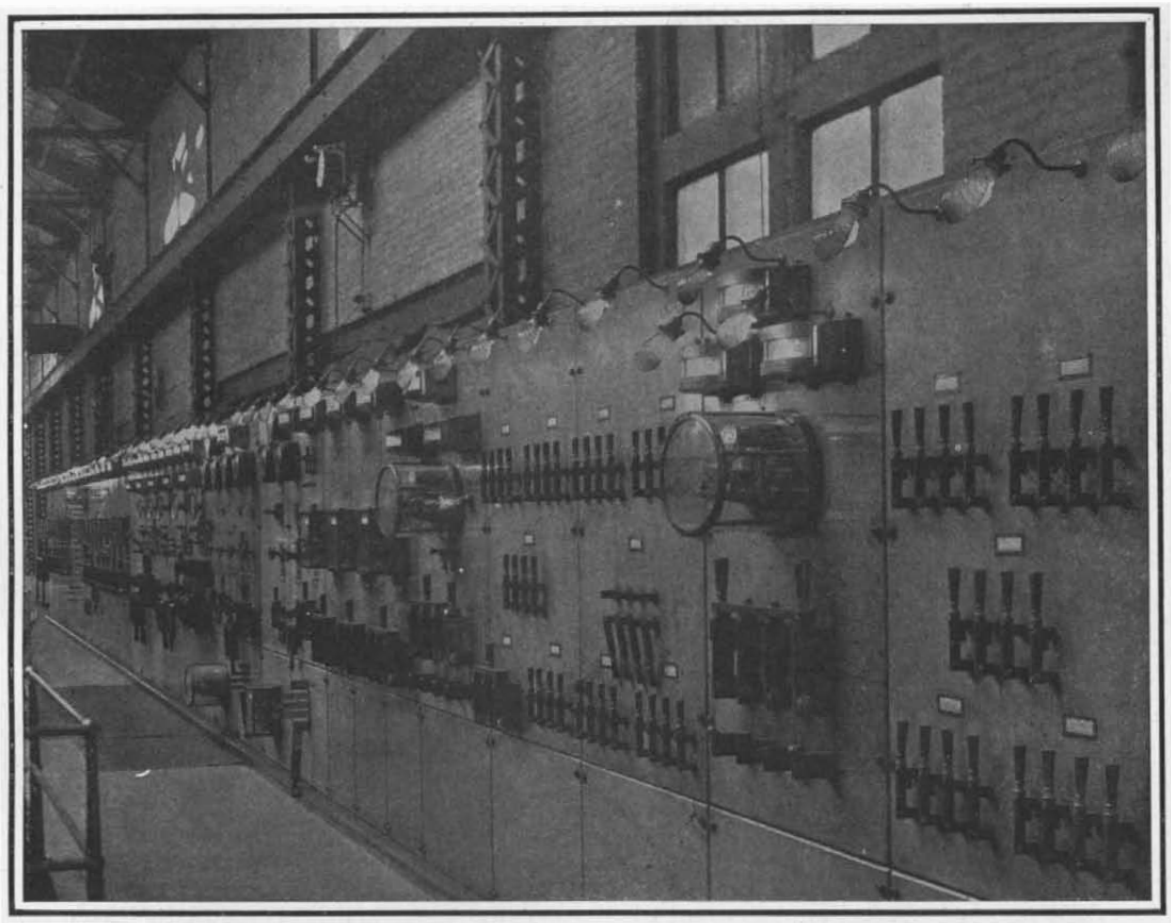
A United States inspector at work.

THE MEAT INDUSTRY OF AMERICA.—II.

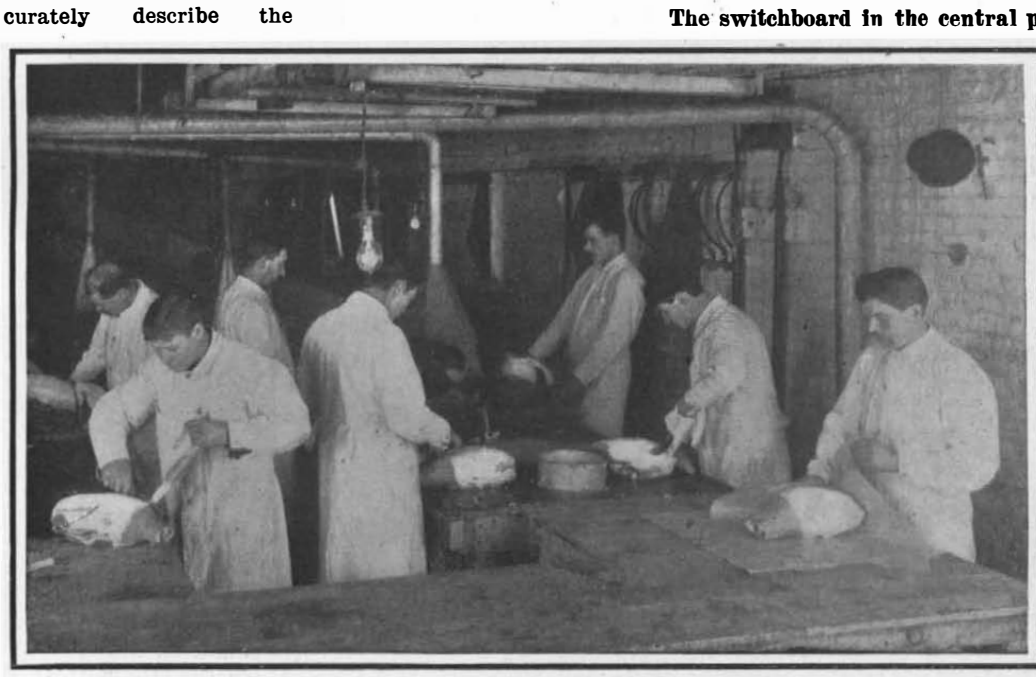
here, that in order to make sure of the thorough impregnation of the ham by the curing pickle, a certain amount is forced into the meat at the bone by means of a hollow needle, through which the liquid is driven by a hand pump. The importance of this treatment is pointed out in an article in the Lancet of June 27 of the year 1908, by Dr. E. Klein, of London, who showed that, in hams so treated, it rarely happens that the pickling fluid fails to reach right through the bone from the outside. This process is shown in one of the accompanying engravings.

The smoked hams are now taken to the packing room, where, after being tested by an expert, who thrusts a steel "trier" into the body of the meat, they are wrapped in oiled paper and wrapping paper, and placed in muslin bags. After these have been sewed up, the company's label and also the United States inspection label are pasted on, and the hams are ready for packing. The company's labels for this and every other kind of meat must be submitted to the Agricultural Department of the government, in order that it may be determined that they accurately describe the character of the contents. In the first section of the present article, published in our last issue, reference was made to the fact that the profits of the large packing houses depend very largely upon the successful treatment of the by-products. We will now give a brief description of the methods by which the forty-two per cent of the animal which formerly was considered as useless refuse is manufactured into valuable commodities. The various scraps of meat, etc., consisting of odds and ends of the cutting room, are collected and placed in large digesters. There they are treated under steam at forty pounds pressure for from eight to ten hours. The fat which is separated by this process is drawn off and utilized as tallow and grease, and in various arts, such as the manufacture of soap, candles, lubricants, etc. The remaining contents are placed in a hydraulic press, where the liquids are squeezed out; and the solids, thus obtained, are dried and ground ready to be made into fertilizers, for which they are valuable because of their content of nitrogen and phosphoric acid. The liquid which drains from the press is evaporated to dryness, and the solid residue, which is rich in nitrogen, is used in the manufacture of fertilizers.

The hides are cleaned, sorted, and shipped to the tannery. The bones are

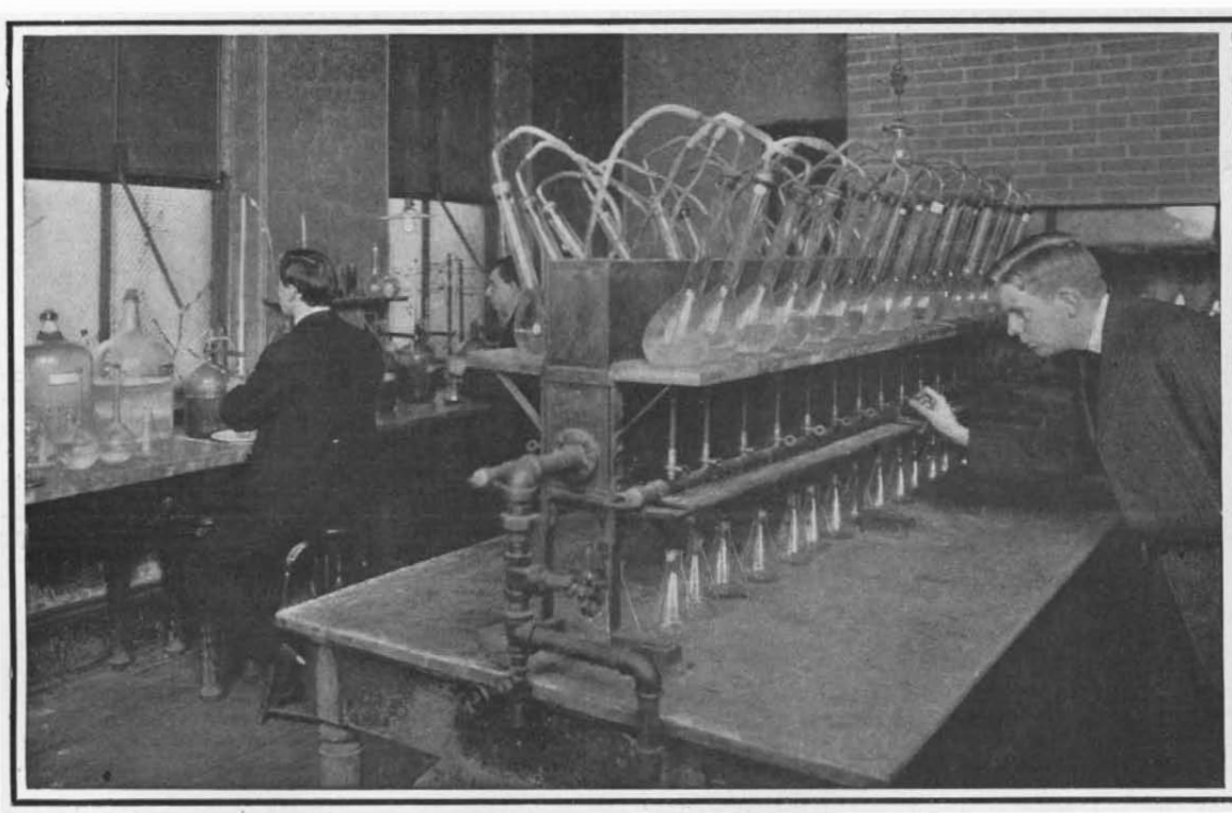


The switchboard in the central power station.



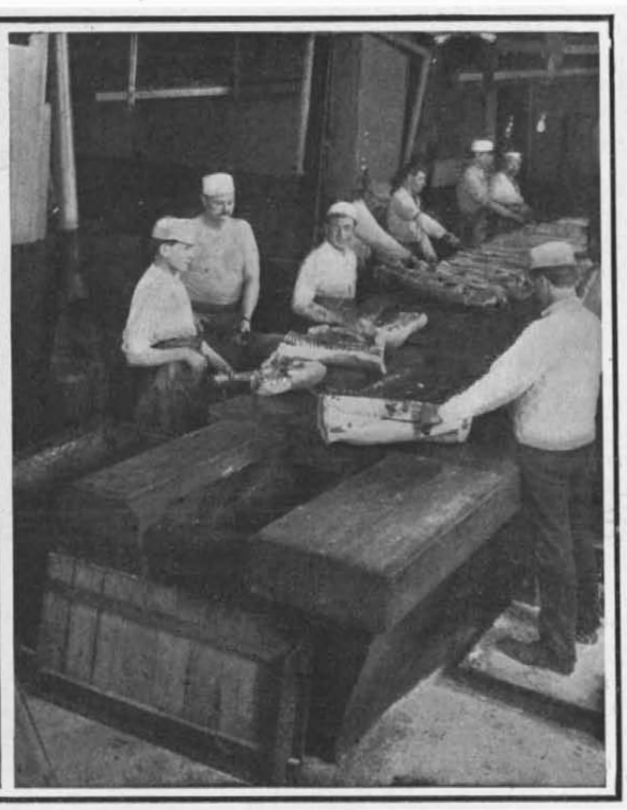
Trimming and wrapping fresh pork-hams.

Branding hams.



A large laboratory is maintained in which a corps of chemists and bacteriologists is engaged in making constant tests of the meats and supplies used, and in searching for improved methods of curing and refrigeration.

One corner of the laboratory.



Making primal cuts of pork-hams, shoulders, loins, and barreled pork.

THE MEAT INDUSTRY OF AMERICA.—II.

first boiled to remove the meat from the fat; then dried and sorted as to size and shape, and sold to the manufacturers of buttons, combs, and similar articles. The hoofs and horns are washed, dried, and sold to comb factories.

The hair of the animal is treated according to its length. Short hair, obtained in the summer, is placed in the digester, dried, and ground into nitrogenous fertilizer material. The long winter hair is cooked in a vat with an alkali, to dissolve the roots and gelatinous matter, and is then washed, dried, and baled for shipment to the hair spinner. It is chiefly used in the manufacture of mattresses. The sinews and hide trimmings are manufactured into glue. The material is placed in a solution of lime, where the fatty matter is saponified, and then washed to free it of lime and render it clean. It is next treated with a weak solution of sulphurous acid to neutralize it; after which it is cooked at a low temperature in large wooden tubs and formed into a glue solution, which is finally reduced in a multiple-effect vacuum machine to the sheet glue of commerce.

It would be difficult to find another of the industries of America in which the application of modern science has wrought better results than in the great meat industry. The adoption of strictly scientific methods has not only improved the quality of the meats, but it has made it possible to transmute the enormous wastes of an earlier day into a wide variety of profitable and useful articles of industry and commerce, and thereby reduce the cost of the entire output.

Silk-Faced Cotton.

The success of artificial silk has caused silk-faced cotton to be somewhat neglected, but "brilliant-ed" cotton closely resembles fine natural or artificial silk. The following are some of the processes:

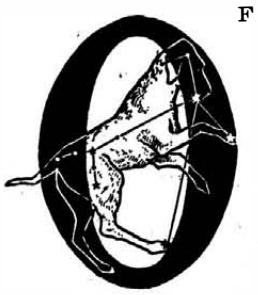
Thomas and Prevost (1907). A hard silky coating is produced by treating the cotton with strong chlorinated bleaching agents and then mercerizing in the usual way, with caustic alkalies. Cross and Bevan recommend the formation of a coating of viscose by mercerizing with caustic soda mixed with carbon disulphide. Cross and Briggs (1907) employ a complex acetic bath, the action of which is confined to the outer layers of the fiber. The bath contains 92 parts of anhydrous acetic acid, 11.5 parts of acetyl chloride, and 6.5 parts of zinc oxide. Prudhomme (1904) mercerizes with caustic soda mixed with ammoniacal solution of copper.

In all of these processes the silky coating is made from the cotton itself. In others, the cotton threads are dipped in collodion, gelatine, solution of natural silk in zinc chloride, solutions of cellulose or artificial silk, etc. Many patents for the production of artificial silk mention the possible employment of the solutions in giving gloss to cotton threads and fabrics. A coating of viscose increases the strength, in addition to improving the appearance of cotton, but produces uneven results and necessitates subsequent bleaching.

It is found that in an ordinary room, from which sunlight is excluded, the brightness of the daylight commonly runs as low as 1/10, or even 1/100 candlepower per square inch. The intrinsic brightness of nearly all artificial lights is much greater than this, which accounts for the injurious effects they produce on the eyes if situated within the range of vision. In a paper read before the Illuminating Engineering Society of Philadelphia, J. E. Woodwell discussed this subject, arriving at the conclusion that the best illumination is a diffused light of from 2/10 to 1/10 candlepower per inch. Although ultra-violet light has heretofore been held accountable for strain and other injury of the eye, he points out that there is less ultra-violet light in the rays of various incandescent illuminants than in direct or even reflected sunlight.

THE HEAVENS IN FEBRUARY.

BY HENRY NORRIS RUSSELL, PH.D.



Of all the aspects that the heavens present to us, none is more impressive than a clear winter night. It is not only that the air is at its clearest, and that the leafless trees hide but little of the sky; the stars themselves at which we are looking are brighter than those which we see in summer.

Let us go out into the frosty air, turn our back upon the Pole Star, and glance at the southern sky. The first thing that we see may well be Orion, whose outline we traced among the stars last month; but as we let our eyes fall toward the horizon, we are arrested by a star of surpassing brightness, so much the superior of all the others that no one could fail to pick it out at once. This is Sirius, the principal star in the constellation Canis Major, and the brightest in all the heavens.

Our map, and the outline figure above, show us how the other stars of this constellation are situated. The conspicuous group resembling an irregular cross about fifteen degrees southeast of Sirius is the Great Dog's hind quarters; and two isolated ones farther to the right, mark his fore and hind paws. It takes a good deal of imagination, when only the stars are before one, to see any resemblance to a dog; but the constellation, however it might be named, is a natural group, and stands well separated from all others.

Sirius deserves further mention. It is notable not only for its brightness, but for its large proper motion, which carries it in a southwesterly direction—almost in the opposite direction to that in which Procyon lies—at the rate of about one degree in 3,000 years. This seems slow, but when magnified by the telescope, the motion in even a single year can be detected with certainty by suitable measurements, and it is much greater than that of most stars. All this makes it seem likely that Sirius is really near us—as the stars go—and the determinations of its parallax show that this is really the case. In fact, so far as the latest researches show, it is nearer to us than any other star that is visible in our latitude, its distance being about 8½ light years. That is, its light takes 8½ years to reach us, and we see it now as it was—and *where* it was—in the middle of the year 1900.

Sirius has of course been very frequently observed, and it was discovered long ago that unlike most stars, it was not moving in a straight line. If its positions, as found by observation for successive years, were mapped, they will lie on a wavy curve, deviating, now to the right and again to the left, from the direct line. The "waves" occurred regularly, at intervals of about fifty years.

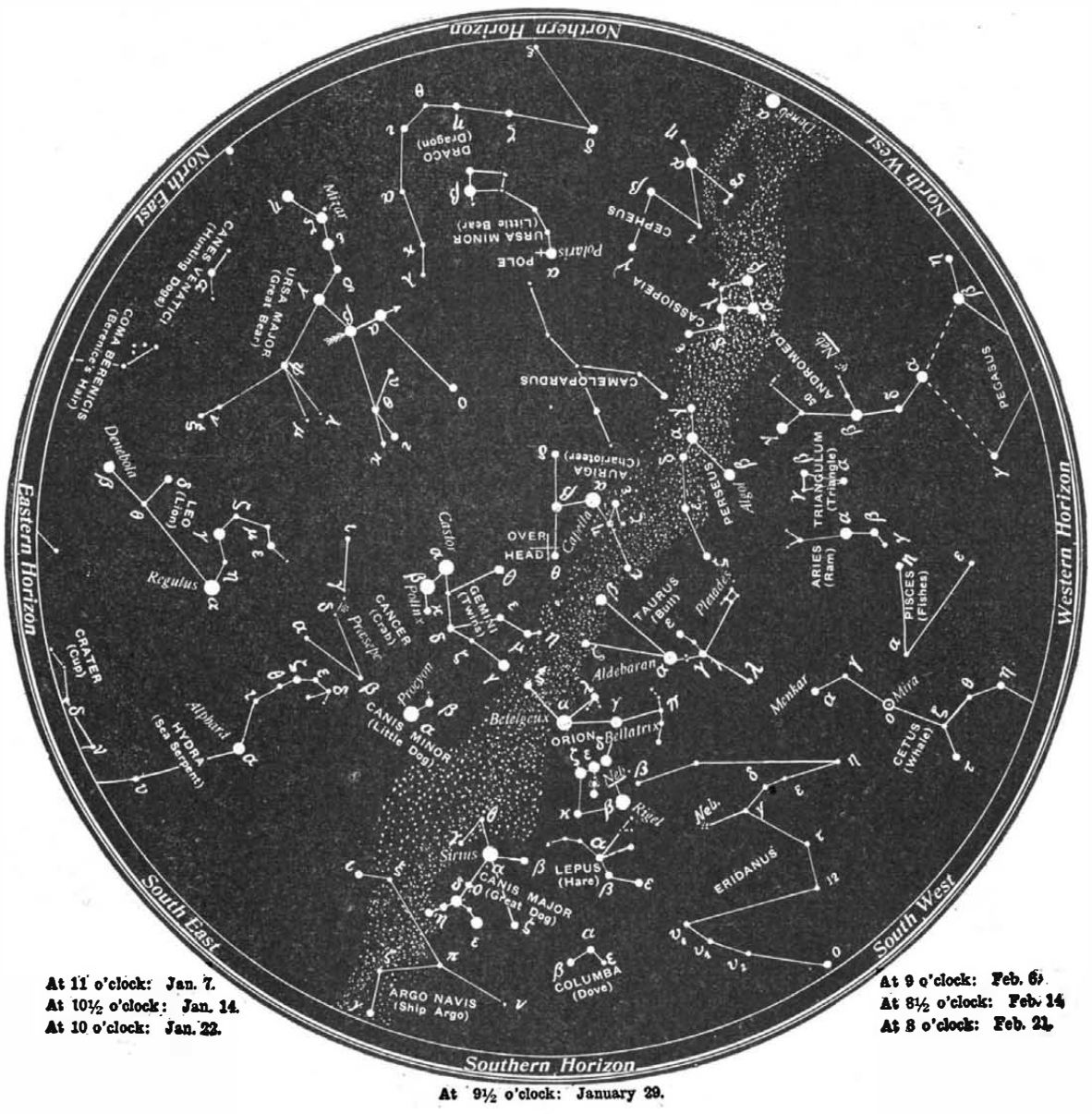
Now, according to the basal principles of mechanics, no moving body deviates from a straight line unless some force acts on it. In the case of Sirius, there was evidently a periodic force at work, pulling it alternately to the right and left—and also setting it forward or behind—and repeating itself after fifty years. The only available explanation was that Sirius was attended by a companion star, too faint for us to see, but sufficiently massive to affect its motion by its attraction, which pulled it now one way, now the other, as the companion star moved round Sirius in its orbit—the period of revolution being of course fifty years.

This explanation was given by the German astronomer Bessel about 1850. Fully twelve years later—in 1862—Alvan Clark, the maker of all the greatest American telescopes, having completed a new instrument of great power, turned it on Sirius. At once a faint companion star appeared—too faint to be seen with the smaller telescopes previously in existence—and this was just in the direction in which Bessel had predicted. Since then it has almost completed a revolution about its primary, moving exactly as was predicted, before it had ever been seen.

Above Orion, on the opposite side from Sirius, is Taurus, with the clusters of the Pleiades and Hyades, of which we spoke last month. Right overhead is Auriga. Gemini is close on the southeast, and Canis Minor, with the bright star Procyon, lies below.

In the southeast is part of Hydra, and due east is Leo, in the lower part of which is the brilliant planet Jupiter. Ursa Major is high in the northeast. Draco and Ursa Minor are due north, below the pole, and Cassiopeia and Cepheus are in the northwest, with Alpha Cygni (Deneb) on the horizon below them. Pegasus is setting, north of west. Above him is Andromeda, and higher still, almost overhead, is Perseus. The remarkable variable star Algol, in this constellation (which is eclipsed by a dark companion at regular intervals of 2d. 20h. 49m.), will be faint (i. e., eclipsed) about midnight on the 6th, 9 P. M. on the 9th, 6 P. M. on the 12th.

Due west we find Aries and Pisces. Saturn, which is in the latter, is just setting. Cetus and Eridanus fill up the large dull space in the southwestern sky.



At 11 o'clock: Jan. 7.
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.

At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

At 9½ o'clock: January 29.

NIGHT SKY: JANUARY AND FEBRUARY

THE PLANETS.

Mercury is evening star until the 11th, when he passes through inferior conjunction and becomes a morning star. At the beginning of the month, when he sets at about 6:40 P. M., he may be seen shortly after sunset.

Venus is morning star, but is steadily getting nearer the sun, and becoming harder to see. All through the month she rises at about 6 A. M., but as sunrise comes earlier and earlier, she will be harder to see. On the 19th she is in conjunction with Mercury, who is then four degrees south of her. Mars is morning star in Scorpio and Sagittarius, rising about 3:20 A. M. on the 15th.

Jupiter is in opposition on the 28th, when he rises at sunset, and is visible all night long, and a fine object in the smallest telescope. Saturn is evening star in Pisces, setting about 9 P. M. in the middle of the month. Uranus is morning star in Sagittarius, observable before sunrise. Neptune is in Gemini, invisible without a telescope. On the 16th he is in R. A. 7h. 3m. 25s. and declination 21 deg. 53 min. north, and is moving 5s. westward and 9 min. northward per day.

THE MOON.

Full moon occurs at 3 A. M. on the 5th, last quarter at 8 A. M. on the 13th, new moon at 6 A. M. on the 20th, and first quarter at 10 P. M. on the 26th. The moon is nearest us on the 20th, and farthest away on

the 8th. She is in conjunction with Neptune on the 2d, Jupiter on the morning of the 7th, Mars on the 15th, Uranus on the 17th, Venus and Mercury on the 18th, and Saturn on the 22d.

Princeton University Observatory.

SOME BREADS OF OTHER LANDS.

BY L. LODIAN.

One of the brothers Reclus, professor of geography at the Brussels University, has left a posthumous work (as yet unpublished) entitled "L'Histoire du Pain." When this History of Bread is issued in due course, it may be taken for certain that it will be—considering its source—a most important contribution to sociologic literature. For the subject has never been "done" before. A like remark applies to the present paper on some of the curious breads of other nations. The writer, before beginning work on it, looked up every source of reference.

THE KASAVA BREAD OF LATIN-AMERICA.

This is the naturally whitest of all breads—without any of the so-styled "electrical" bleaching of modern roller-mill processing. The name is derived from the Caribbean-Indian word of the plant *kasabi*, and is variously spelled *kasava*, *casava*, and half a dozen other ways. However, as the tendency of the times is toward the restoration of indigenous spelling, *kasava* is perhaps the best rendering of *kasabi*.

When the Genoese Colon first reached the Isles of the Antilles, he found the aboriginals using for bread the pulped root of this kasabi plant. Later, the *tortilla* (maize bread) was found in use on the mainland.

Kasava bread is a most important article of diet to this day among the natives of tropical America, especially in interior Brazil and Paraguay.

For convenience in baking, it is always made in thin wafer-like cakes, as noted by the earliest travelers. Taken with coffee, it is a quite "satisfying" diet—far more than it looks—due to its rapid absorption of moisture and swelling to produce that feeling of distension which is called "filling."

Blackest of all breads is the *palt brod* of Lapland, northern Scandinavia, Russia, and the far north of Siberia. It is a kind of rye bread, and is regarded as highly nourishing—as it must be when reindeer sledge parties subsist on it and unsweetened brick tea for weeks together, with an occasional diet of fish. It has a slight albuminous taste; and is sometimes soaked in hot reindeer fat to augment, not its nutritiveness, but its heat-imparting capacity.

The Norsemen also have a peculiar hardtack bread of unmilled rye. The rye grains are soaked, mashed by pounding, then lightly baked in circular plate-like disks about twelve inches diameter, and one-tenth to one-seventh of an inch thick. In its center is a hole, and it is stored by racking away on thin poles after baking; or suspending by batches on strings below decks on fishing smacks (for it is the chief bread of the fisher folk). It is eaten with and by dipping in the soups, or by stirring in the coffee, or even alone, like biscuit.

The Italians have a nearly similar disk-like hole-centered bread for their coast-working population. It is known as macaroni *pane duro* (macaroni hard-tack), and is eaten by momentary soaking in their cheap light wines; it may be used in the soup, but is always inferior to the real strip or perforated macaroni. Like this last, it is of a light yellow color, brittle, and has nearly the same glutinous taste.

So diverse is the population of New York, that most breads of different nationalities can be obtained in their respective bakeries. Thus, the characteristic three-cornered oat bread, in cake-like form, can be obtained at several Scotch bakeshops. It lacks, though, the home-made simplicity and purity of the native bannock—being "Americanized" to suit the Scottish-American acquired taste.

It is little known that of all the foreign languages prevailing in New York, the Russian language has the greatest number of speakers. There are about three-quarters of a million familiar with it. True, the vast majority of these are provincial, and mainly converse in their own jargon, but they are as familiar with Russian as the Irishman is with British.

Bread for the hordes of Jew folks, mostly of Russian origin, is quite an industry in the Hebrew quarter of Gotham. There are bakeries for the production exclusively of the matzoths, or unleavened bread. This is both square and round shaped, very friable, and to the Gentile about as uninteresting and insipid a bread as could be conceived. At the same time, it is one of the simplest and purest of breads.

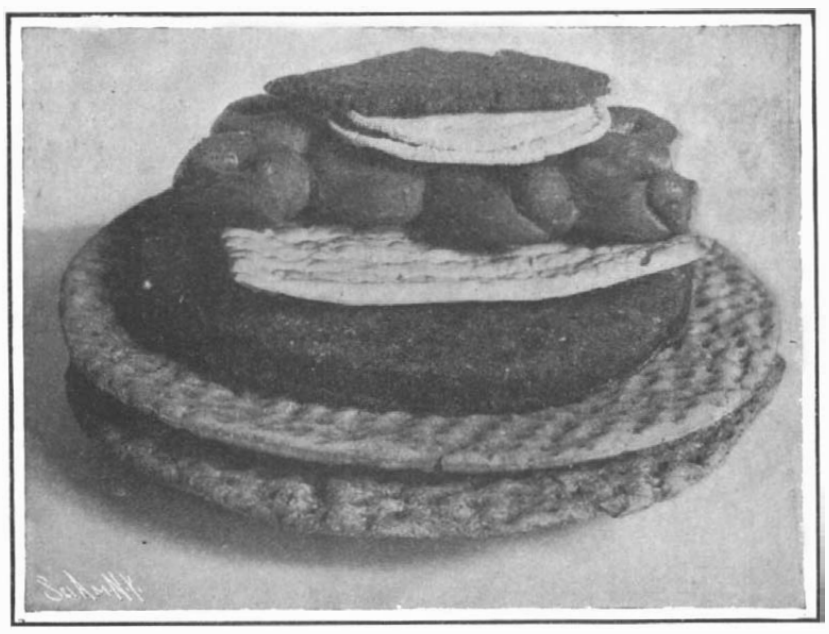
The Italian breads present the greatest variety and solidity and purity of any. Some of their family loaves are big as cartwheels, and retain their table acceptability, without becoming too dry or hard, for a week to ten days. They have also about a dozen varieties of hardtack breads, for dipping in and taking with wine or coffee, or for soup use. But these dried breads, while satisfactory to the Italian, would be pronounced a poor standby by an American. Like meat which has been baked to a crisp, they seem to have had most of the virtue baked out of them by excessive

A LOAF OF ITALIAN BREAD.

heat. The Italian chestnut bread (*kastagnacio*) and bean bread are also obtainable in Manhattan.

Of all the hardtack breads of the universe, I have found (by actual experience during many years of almost every known variety) the small ringed bread of Siberia the most substantial. When the Russian engineering parties were constructing the trans-Siberian railroad, this white ring bread (with the coarse rye bread) was their main "staff of life."

It is made without salt or yeast, and is first steamed, then lightly baked to expel the moisture. Some curious uses were made of these breads by the engineers. When soaked in hot pure tallow for a few moments till they sank, they were used in soups or soaked in and eaten with tea, during the severe winter months. This tallow bread was considered the most heat-producing article in the dietary. It is a product which should be utilized by our Arctic explorers. Another curious use to which it is put is as an extempore candle, or coffee-pot boiler. A nail is used to make about eight holes in the tallow ring bread; wax vestas are placed in these and ignited. It will burn slowly for about an hour, emitting a strong heat sufficient to warm and light a small tent, and boil the tea or coffee



SOME CURIOUS FORMS OF BREAD.

water. There is a rather strong odor of toasting bread, but that is tolerated in preference to smoke. While sojourning with the engineers in Siberia, I have also seen them using the larger sizes of ringed bread as makeshift quoits for Sunday afternoon sport in their tents, and the bread would stand the knocking about pretty well, and would eventually appear in the soup at the evening meal.

Small Siberian storekeepers also use the ringed bread as an abacus, or primitive counting apparatus for calculating small sums in rubles and kopeks, and simple figuring. Three strings are suspended above the counter; ten breads are strung on each; the top line represents the rubles (their money transactions rarely going above ten) and the two lower strings stand for the kopeks. Of course, the strings of bread can be increased to mount into the thousands and up, if desired. Even this singular multi-usable bread can be obtained in Manhattan at various bakeries of erstwhile Russian citizens, but its use is here confined to the table.

Bread has various applications besides table use. We are all familiar with its therapeutic uses as poultices *et al.*; for erasing stains and marks; for (toasted to a crisp) the infusion known as toast water, and a dozen other uses.

Perhaps its most singular application is—in the form of dough—its use for cleaning parts of timepieces in one of the Waltham watch factories. A recently printed statement gave out that one of these New England horological factories used up some eighty pounds of bread dough per diem for this purpose. The refuse was not wasted, but used on a chicken farm in the region.

The "Bishop Ring" is Seen Again for the First Time Since Its Discovery.

For several months after the eruption of Krakatoa in 1883, there was a haziness in the atmosphere, and remarkably gorgeous sunsets were observed in various parts of the world. The great eruption of Mont Pelée in Martinique was followed by similar phenomena. The generally accepted theory among scientific men as to the cause of these phenomena was propounded by Dr. Sereno Bishop of Honolulu, and is known as the Bishop theory. At the same time Dr. Bishop observed a ring round the sun, to which the name of the "Bishop ring" was given. On the first of January Dr. Bishop, for the first time since the eruption of Krakatoa, observed the sun ring, and attributes its appearance to the recent disturbances in Sicily and southern Italy. The Bishop theory is that a volcano in very active eruption throws out immense volumes of impalpable dust into the higher strata of atmosphere, and that this dust spreads through the rarefied air until it surrounds the globe.

Dr. Bishop is the oldest living white person born in the Hawaiian Islands, and has devoted much study to volcanoes and their phenomena. He is now eighty-two years of age.

The residents of Geneva in Switzerland say that for two days about three weeks before the earthquake at Messina in Sicily, the waters of Lake Geneva rose and fell in a strange manner, as though sucked in by a siphon and then permitted to flow out again. It is said that the same phenomenon was observed before the earthquake on April 18, 1906, in San Francisco.

The Current Supplement.

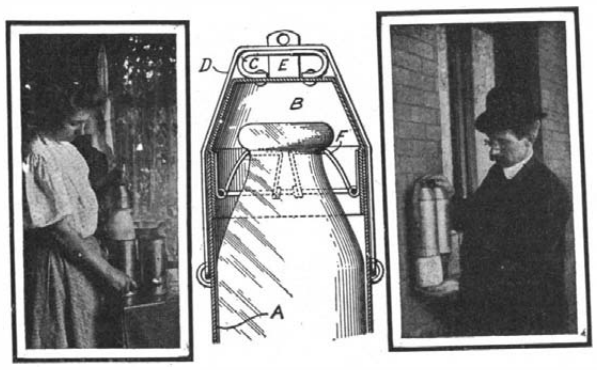
Never has an earthquake exacted so terrible a toll of human life as that which has just devastated Calabria. A scientific examination of this calamity is presented in the current SUPPLEMENT, No. 1726. Some twenty pictures are used to illustrate the article. Gas producers for use on shipboard have been pretty well discussed, but all the arguments have presupposed that the present type of slow-speed high initial pressure explosive engine would be used. E. W. Percy in an essay entitled "A Large Gas Engine for Ships" inquires whether a more suitable type of engine cannot be constructed, and argues that the 2-cycle, 3-cylinder fuel injection engine is the coming type. About ten years ago were discovered the first remarkable exceptions to the general rule that crystals are solid and rigid bodies. Prof. Ernst Sommerfeldt reviews the history of that discovery, and gives a brief and succinct account of the present state of our knowledge. Lombroso gives his views on the happiness of lunacy and genius. R. E. L. Maunsell writes on modern workshop practice, in which he discusses high-speed tool steel. Dr. Gradenwitz describes a method for wirelessly transmitting handwriting, drawings, and photographs. Our aeronautical readers will be interested in W. R. Turnbull's account of his new researches on the form and stability of aeroplanes. The Science, Engineering, and Trade Notes and Formulæ are given as usual.

Much success has been attained in repairing automobile crank or gear cases. The sides may be knocked out completely; but to the surprise of many who are not only well posted, but scientific in the art, welding of the damaged parts has been accomplished so as to make the case one solid piece. This new method of repairing gear cases saves the owner of a car not only considerable expense, but much time and delay. In engines of foreign make, for example, it takes from three to four months to get new aluminium cases, and then the cost is very much higher than what it would cost to weld them.

Patent Department

MILK-BOTTLE HOLDER.

It is sometimes rather difficult to fix the blame when the morning's milk is not to be found at its usual place on the doorstep. Either the milk has been stolen, or the milkman is dishonest and has failed to deliver the order. The honest milkman, as well as the housewife, will welcome some sort of a milk-bottle receptacle which will securely lock the bottle until such time as the authorized person is ready to take it in. Such a device is shown in the accompanying engraving. The line drawing shows a section through one of the bottle receptacles. It will be observed that

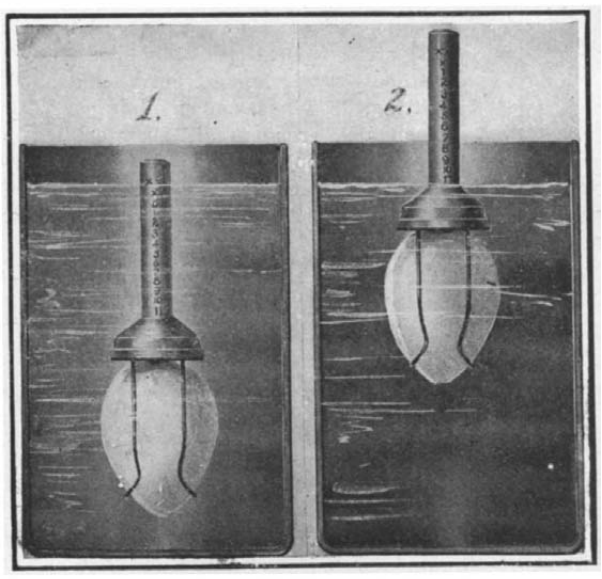


MILK-BOTTLE HOLDER.

it consists of a cylinder *A*, open at each end and a metal cap *B*, which fits into the top of the cylinder. The cap is secured thereto by means of a padlock fastened on a bracket member *E*, which passes through the handle *C* of the cap, and a bail *D* hinged to the cylinder. Within the cap is a wire retainer *F*, of such form that when the bottle is inserted in the cylinder from the bottom, the neck of the bottle is seized by the retainer, and held so that the bottle cannot be withdrawn. The only way in which the bottle can now be removed is to unlock the padlock, so that the cap may be removed from the cylindrical part of the receptacle. The bottle will be lifted out with the cap, and can be disengaged from the wire retainer. A separate receptacle is required for each bottle, but these can all be secured to a single bracket and fastened by a single padlock. It is impossible to steal the bottle from a receptacle of this sort without tampering with the lock, or otherwise damaging the receptacle in such a way that the work will be recognized as that of a thief. The inventor of this milk-bottle holder is Mr. Frank Weisenberg, of 148 Prospect Avenue, Brooklyn, N. Y.

DEVICE FOR TESTING EGGS.

A well-known test for eggs consists in placing the eggs in water, when the bad ones will float, but of the eggs that sink there is no way of determining which are the fresher ones and how much less stale one may be than another. A very ingenious device has recently been invented which enables one to note the slightest variations in the eggs. The device consists of an aluminium air chamber comprising a main body portion and a stem. The latter is graduated, while at the bottom of the body portion are two spring-wire loops shaped to engage and hold an egg. The device with the egg attached thereto is placed in water and will sink to a depth depending upon the specific gravity of the egg. The freshest and best eggs sink the stem down until the water is on a level with the *XX* mark. Even if the egg registers 0 it shows that the egg is quite fresh and still has sufficient food strength to hatch a live chick. Mark 4 registers the limit of fair eating. At 8 the egg is fit for cooking only, while 12 shows that decomposition has set in. Not only is the tester valuable in the kitchen but to the chicken raisers as well, as it tells how much nutriment there is in the egg for the support of life in the chick, and during incubation it shows the progress of evaporation in the incubator as compared to normal hygrometric conditions as found in the eggs under the hen.

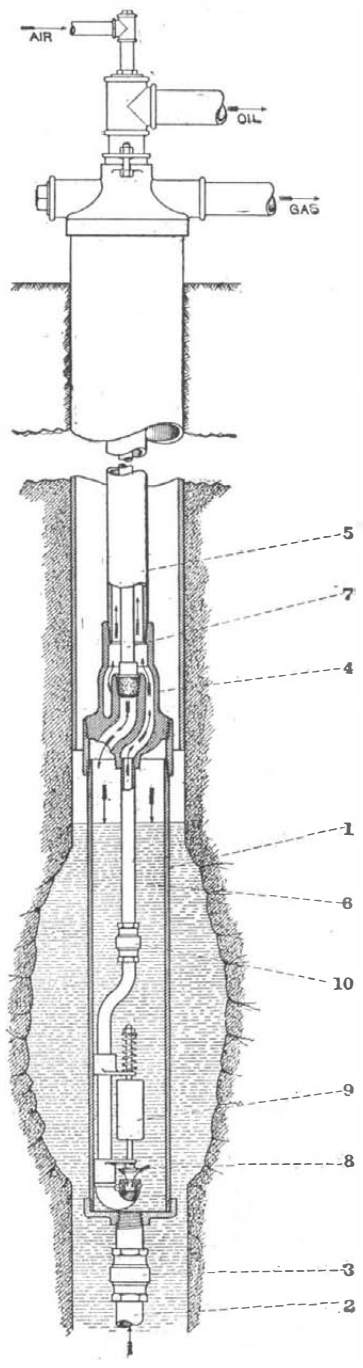


DEVICE FOR TESTING EGGS.

The inventor of this egg tester is Dr. E. C. Waldorf, of 496 Porter Avenue, Buffalo, N. Y.

FLOWING OIL WELLS BY COMPRESSED AIR.

Compressed air is being used very successfully in the flowing of oil wells on the farm of Mr. John W. Waitz near Oil City, Pa. One hundred wells are thus equipped and they yield a daily average of 200 barrels. The average depth of the wells is 800 feet, and the air pressure required is somewhat more than 400 pounds per square inch. The equipment of the wells will be readily understood by a reference to the accompanying engraving.



FLOWING OIL WELLS BY COMPRESSED AIR.

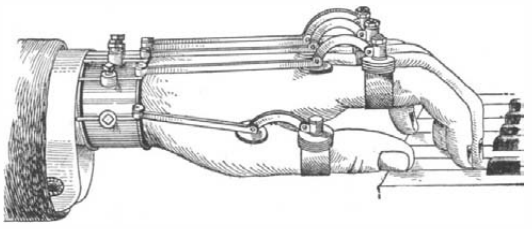
An oil receiver 1 is located in close proximity to the bottom of the well, presumably in the "shot hole," in the oil-producing stratum; into this receiver oil flows by gravity through the inlet pipe 2, which is provided with a check valve 3. The receiver is attached at its upper end to the by-pass 4, which in turn is attached to the tubing 5. An oil-delivery pipe 6 extends from the by-pass down into close proximity to the bottom of the oil receiver. An air-inlet 7, which is provided upon its lower end with a suitable packer, seats firmly in the upper end of the by-pass. The receiver 1 is composed preferably of 4¼-inch casing, and varies in length from 60 to 200 feet, depending upon the capacity or production of the well.

When the well is to be flowed, air is admitted to the upper portion of the receiver and, acting upon the surface of the oil, forces it downward into and through the delivery pipe 6, into the tubing 5, thence to the surface into a receiving tank or any suitable receptacle. Pipe 6 is provided at its lower end with an automatic valve. To the stem of disk 8 of this valve is attached a float 9, the weight of which is nearly balanced by a spring; when the float is submerged in fluid it is buoyed up and the valve-disk is held up from its seat. When the oil is forced from the receiver, the float lowers and causes the disk to seat, thus preventing the entry of air into pipe 6. A check valve 10 prevents the return of oil from the pipe 6, or tubing 5, into the receiver, so that said pipe and tubing always stand full of oil. The number of times that wells are flowed daily, depends upon the amount of oil they produce.

One of the valuable features is the "compounding" of the air. This operation consists in utilizing the air more than once. The air is turned into well No. 1, and when this well ceases to flow, a pressure gage upon the air pipe leading to it will show a pressure of say 400 pounds. Communication is now closed between the air pipe of well No. 1 and the air compressor or air receiver, and the air pipe leading to well No. 2 is placed in communication with the air pipe leading to well No. 1; the air now flows from well No. 1 to well No. 2 until the air pressure in the two wells equalizes, and when the pressure gages show such equalization of pressure, communication between the air-pipes of the two wells is closed, and the remaining air in well No. 1—which is at 200 pounds pressure—is taken back into the air compressor. Receiver or full pressure is then turned into well No. 2 and it is flowed in the same manner as No. 1.

FINGER-DEVELOPING DEVICE.

A recent invention provides a device which may be applied to the hands of a piano player to develop the muscles of the fingers individually, so that the fingers may be able to strike the notes with a uniform blow. The device consists of a wrist band which supports a series of rods, provided at their opposite ends with pads adapted to rest on the knuckles.

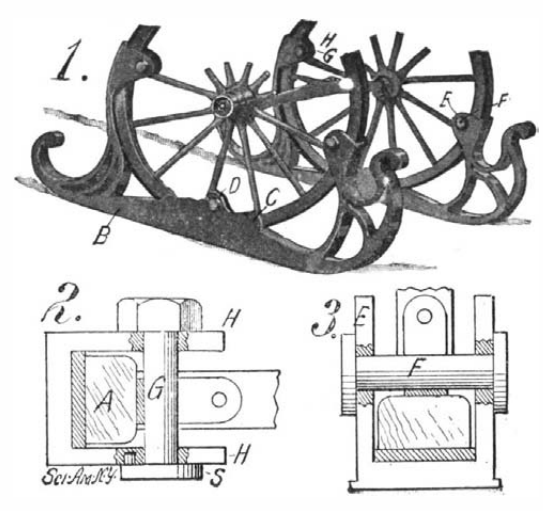


FINGER-DEVELOPING DEVICE.

Hinged to each one of these rods is a short arm connected at its outer end to a stem projecting from a ring slipped over the finger. A series of weights in the form of washers are adapted to be slipped over the stem, thereby permitting the operator to adjust the weight on each particular finger. Thus if one of his fingers is weaker than the rest, it is fitted with a heavier weight, so that in time the muscles will be developed to such an extent as to make it as strong as the rest of the fingers. The inventor of this finger developer is Mr. Fernando Loyola, 5 de Mayo No. 4, Queretaro, Mexico.

VEHICLE WHEEL SLED RUNNER.

The usual method of mounting a wagon on runners is to remove the wheels and support the axles on the runners. This involves considerable labor; and in order to lessen the inconvenience of the operation, the type of runner illustrated in the accompanying engraving has been invented. The runner is secured to the wheel instead of the axle of the vehicle, and may readily be attached or removed. The illustration shows a portion of a wheel *A*, while the sled runner is indicated at *B*. The sled runner is provided with a channeled part *C*, to receive the rim of the wheel, and is formed with a cam-shaped groove, into which the pin *B* is adapted to be fitted. This pin is secured to one of the spokes of the wheel by means of a strap. The forward end of the runner is provided with an upwardly-extending portion *E*, to receive the wheel rim, which is channeled. A cam groove is also formed in this channeled part to receive a pin *F*, secured by means of a strap to the wheel. The rear end of the runner is also provided with a grooved part *H*, adapted to fit over the rim of the wheel, and provided with a pair of eyes through which a bolt *G* may be passed. The bolt head is formed with a pin, which engages a recess in one side of portion *H*. In this way the bolt is kept from turning while the nut is applied. When making the runner fast to the wheel, the rim of the wheel is supported in the channel part *C*, and the bolt *G* is made fast. The wheel is then turned to bring the pins *G* and *F* into their respective cam grooves. It will be observed that the wheel is gripped laterally by the channeled portions of the runner, while the bolt and pins provide three widely separated points of attachment, which securely hold the runner to the wheel. Mr. John Karssen, of Holland, Mich., has recently secured a patent on this sled-runner.



VEHICLE WHEEL SLED RUNNER.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

ENVELOP.—P. MAC A. MACKASKIE, Central, Nev. The invention provides an envelop with non-adhesive, auxiliary detachable flaps, adapted to be removed when the envelop is actually used for mailing purposes but which when in position on the envelop will prevent its sealing flaps from becoming accidentally cemented to the body of the envelop whatever the climate and no matter what per cent of moisture in the atmosphere, and which will also prevent the accidental sealing of the envelop even should it be dipped or dropped in water.

COMPOSITION FOR COPYING-PADS.—R. O. E. DAVIS, Chapel Hill, N. C. In the present patent the invention has reference to compositions for copying pads, the more particular object being to produce a composition tablet having certain desirable properties and used for the purpose of making repeated copies of characters made by ink upon paper.

SEAL.—W. W. TOBEY, Iola, Kan. The invention is an improvement in seals or sealing devices to secure the contents of freight, refrigerator, and other cars, boxes, packages, parcels, mail-bags, etc., from being tampered with while in transit. Means provide for preventing the introduction of any instrument whereby to release the spring from engagement with the key or bolt.

FIREARM.—F. D. ELY, Plainfield, N. J. In this case the object is to limit the vertical dispersion of rifle fire. The invention eliminates all shots badly aimed as to elevation, thereby preventing the present immense waste of ammunition in battle, with its consequent disastrous wear on the bore of the rifle; lessens the difficulties of ammunition supply; insures concentration of fire, renders night firing effective, and vastly improves the morale and efficiency of any army.

HAMMOCK.—J. J. MAXWELL, Washington, D. C. An object of the invention is to provide a frame for a hammock which will keep the hammock spread apart in the most convenient position for the user and at the same time will permit the hammock to adjust itself automatically to persons of different weights who occupy the hammock without any danger of breaking or straining of the frame structure.

WINDOW.—E. A. LEWIS, Mount Vernon, N. Y. The invention relates to improvements in windows, the purpose of which is to provide a construction involving the usual sliding sash, the latter being adapted to be also swung from the window opening preferably to the inside of the room, whereby the passage of the air through the window opening is altogether unobstructed.

HORSESHOE.—G. LOEFFLER, Tampa, Fla. The invention provides a shoe and a removable calk held thereto by a fastening rod which can be moved longitudinally to secure and release the calk, and the shoe is so constructed as to afford a socket receiving the calk, and to afford means for engagement by the rod when adjusted to hold the calk to the shoe.

COLLAPSIBLE SHIPPING-CASE.—G. O. HELVIG and A. W. EWING, Dawson, Minn. The invention relates more particularly to an improved construction whereby the case when empty may be folded to occupy the minimum amount of space and rigidly locked in position so that the parts going to make up the case may be held rigid in respect to each other when the case is in its open or extended position.

PIPE.—H. LEIDEL, New York, N. Y. Mr. Leidel provides a cleaner of a strip of metal or other relatively stiff material having its ends helically formed or twisted, with the pitch of the helix decreasing as the ends of the strip are approached, whereby when the strip is withdrawn from the stem the nicotin and other collected matter will not revolve and thus effect its escape, but will pass out with the strip.

BLOCK-MOLD.—H. BRESSER, Toledo, Ohio. This ornamental block-mold is intended especially to be used in forming the markers employed in graveyards for indicating the division of the lots, the position of walks, etc. While the invention is particularly adapted for this purpose, it is capable of general use where blocks are to be molded, having inscriptions or characters in the faces thereof.

Hardware.

CLAMP.—O. B. PERKINS, Gloucester, Mass. The clamp consists of an arm having one end offset at substantially right angles thereto, and a cam journaled on the opposite end of the arm in opposition to the offset portion and adapted to clamp the timber placed therebetween. The under face of the offset portion of the arm is both laterally and longitudinally inclined to give a good bearing surface to the wedge and tend to cause it to move inwardly and draw up the planking when it is drawn in place.

Heating and Lighting.

BOILER-FURNACE.—P. H. MCGIEHAN, Garnersville, N. Y. In this instance the aim is to provide a boiler furnace, which is simple and durable in construction and arranged to insure complete combustion of the fuel, especially when the latter is soft coal, thus utilizing the fuel to the fullest advantage and preventing smoke from passing into the chimney.

Household Utilities.

GATE FOR BEDS, ETC.—H. THURM and A. THURM, New Haven, Conn. The gate is designed to be used in connection with beds, windows, etc., to prevent children from falling out. The aim is to produce a gate embodying strength and simplicity, which may be readily applied to and detached from the side of any ordinary form of bed and which is adapted to be folded up to the head or foot board and thus occupy a removed position when it is not in use.

CHEESE-CUTTER.—W. A. MCELNEY, Meriden, Conn. The aim of the invention is to provide a cheese cutter, for use in stores, hotels, restaurants, and other places, and arranged to permit of conveniently and accurately cutting the cheese into pieces of desired sizes, and to normally keep the cheese covered.

NOISE-PREVENTER FOR COVERS OF RECEPTACLES.—T. B. GARRIS, Hart, Mich. The invention in this improvement is to provide a novel attachment for the cover of a commode vessel, which will obviate noise when the cover is placed on the receptacle, and also effectually seal the joint therebetween, so as to prevent an escape of odor from the contents of the vessel.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 19, 1909,

AND EACH BEARING THAT DATE

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

Acid, naphthylpyrazolone sulfonic, P. Volkmann ... 910,437
Agricultural machine seat, G. F. Danielson ... 909,874
Air brake system, G. Macloskie ... 910,402
Air motor, D. B. Wood ... 910,342
Air operated and controlled mechanism, J. S. Johnston ... 909,907
Air washer, F. E. Donaldson ... 910,045
Alkali recovering apparatus, C. F. Logan ... 910,074
Amusement apparatus, centrifugal, H. N. Ridgway ... 910,417
Amusement device, A. H. Smith ... 909,953
Amusement device, J. de Martino ... 910,403
Anchoring device, A. Scheible ... 909,947
Animal trap, N. J. Barron ... 909,981
Arch supporter, adjustable, J. T. Apgar ... 909,858
Archetypes, making, M. Barricelli ... 909,980
Assembling clip, G. Lidseen ... 910,399
Atomizer, F. E. Nelson ... 910,144
Auger bit connection, miners', S. Tyler ... 909,968
Automobile, etc., lamp, C. H. Bryan ... 910,268
Automobile wind shield, S. D. Hunter ... 910,065
Axle, differential, B. R. Seabrook ... 910,424
Axle, steel, J. E. Symons ... 909,963
Azo lake and making same, E. Ulrichs ... 910,030
Bale band splice, H. B. Johnson ... 910,385
Band brake, double acting, D. N. Thompson ... 910,435
Barrel head, Olson & Libak ... 910,015
Bath cabinet, J. Hermann ... 910,381
Beans, apparatus for baking, F. A. Calley ... 909,988
Bearing guard, B. M. W. Hanson ... 909,983
Beater, H. C. Jarr ... 910,200
Beehive, H. T. Ward ... 909,973
Beehive, J. E. Douglas ... 910,047
Beer wort, preparing, L. Rubsam ... 909,942
Beet lifting mechanism, W. B. Fox ... 910,467
Bell, electric, G. L. Patterson ... 910,412
Belt, electric, Hornung & Sperling ... 910,474
Bending machine, L. E. Rice ... 909,936
Bending machine, J. A. Gerlock ... 910,282
Berth ladder, Duncon & See ... 909,876
Blade and handle, separable, R. H. Juenge ... 909,908
Blind adjuster, Venetian, W. McKnight ... 909,927
Block. See Pulley block.
Board forming machine, pulp, F. M. Chapman ... 910,358
Boat pusher head, W. Schilling ... 910,090
Bobbin, W. W. Burke ... 909,986
Boiler, J. Kindervater ... 910,133
Boiler cleaner, Dreijer & Haight ... 910,183
Boiler stay bolt, B. E. D. Stafford ... 909,956
Boiler stay bolt, J. Deneal ... 910,361
Boilers, air feeding appliance for oil-burning steam, Heintzelman & Camp ... 910,285
Bolster and draft rigging, combined, W. H. Scott ... 910,151
Book lock, S. H. Allison ... 910,260
Boot cleaner, J. P. Orfe ... 909,930
Bottle cap or closure, C. Hammer ... 910,128
Bottle filling machines, bottle centering device for, J. H. Champ ... 909,868
Bottle, non-refillable, A. Hammerstein ... 909,890
Bottle, non-refillable, C. Standard ... 910,093
Box fastener, G. H. Maas ... 909,918, 909,919
Box for holding and transporting bottles, W. H. Rittler ... 910,316
Brake hanger, non-chattering, A. E. Zimmer ... 910,160
Brake shoe key, O. G. Seaman ... 910,425
Brush, air, O. C. Wold ... 910,341
Brush, commutator, C. B. Mills ... 910,214
Bucket, dump, L. Wolfley ... 910,253
Bucket wheel, A. C. Pratt ... 910,311
Buckle, Young & Libby ... 910,258
Burial casket, M. R. Johnson ... 910,386
Burial vaults, mold for forming, A. O. Hunsaker ... 910,064
Burner, G. Cosmovici ... 910,178
Burner, E. E. Billow ... 910,267
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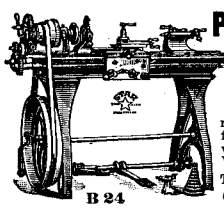

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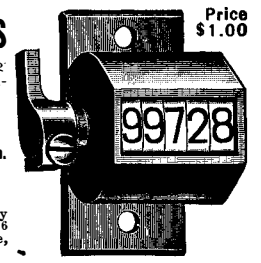

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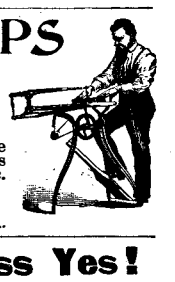

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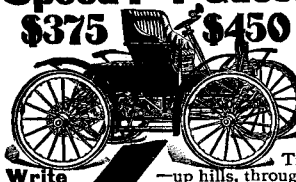

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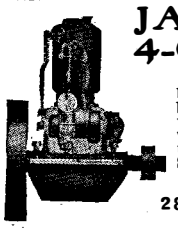

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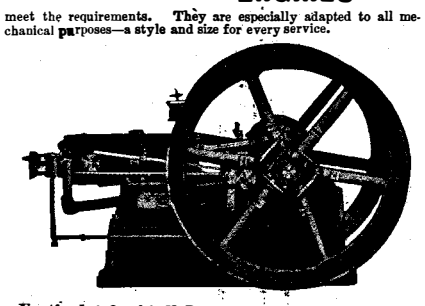

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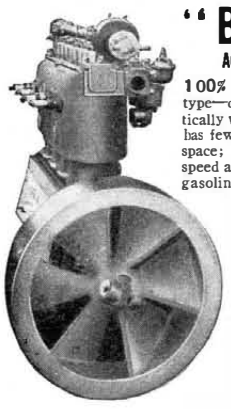

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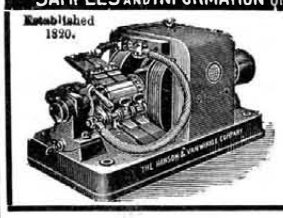

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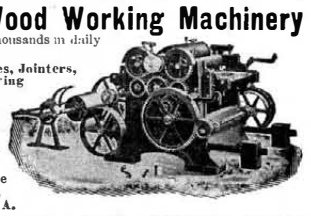

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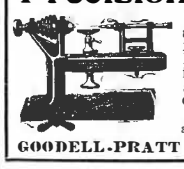

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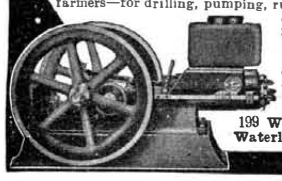

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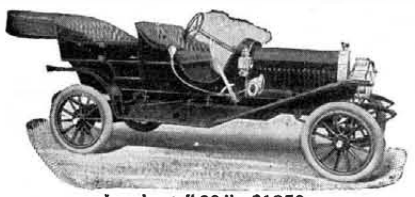

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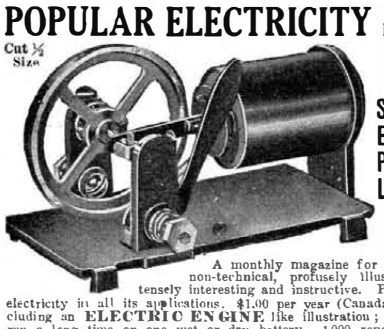

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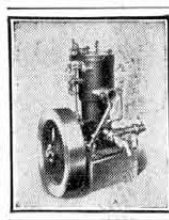

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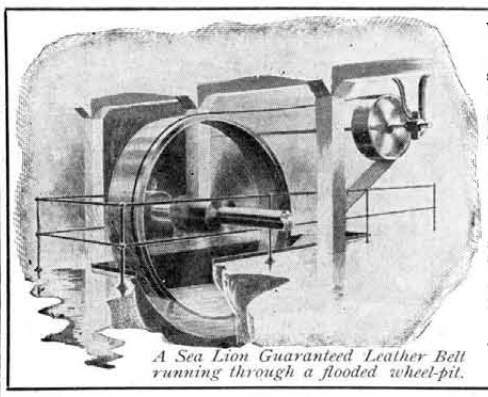

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