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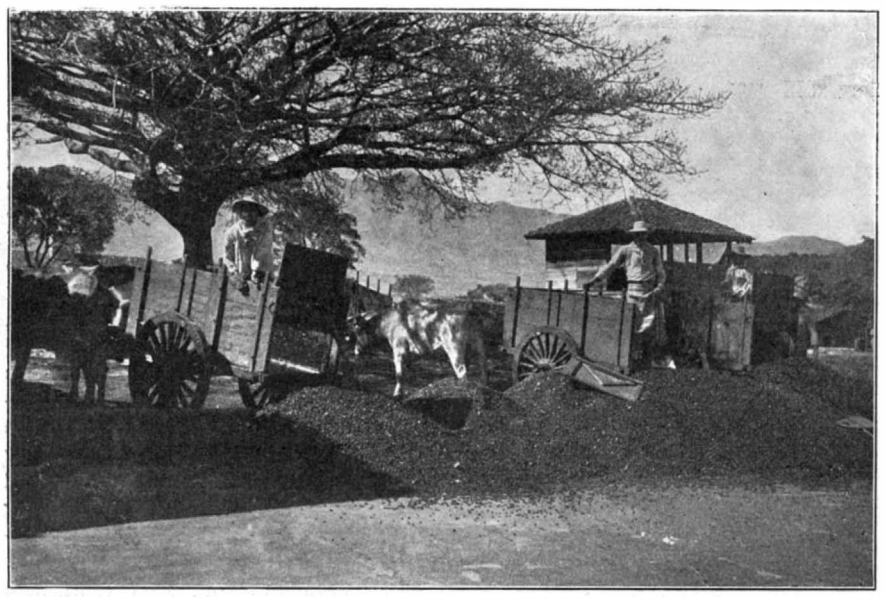
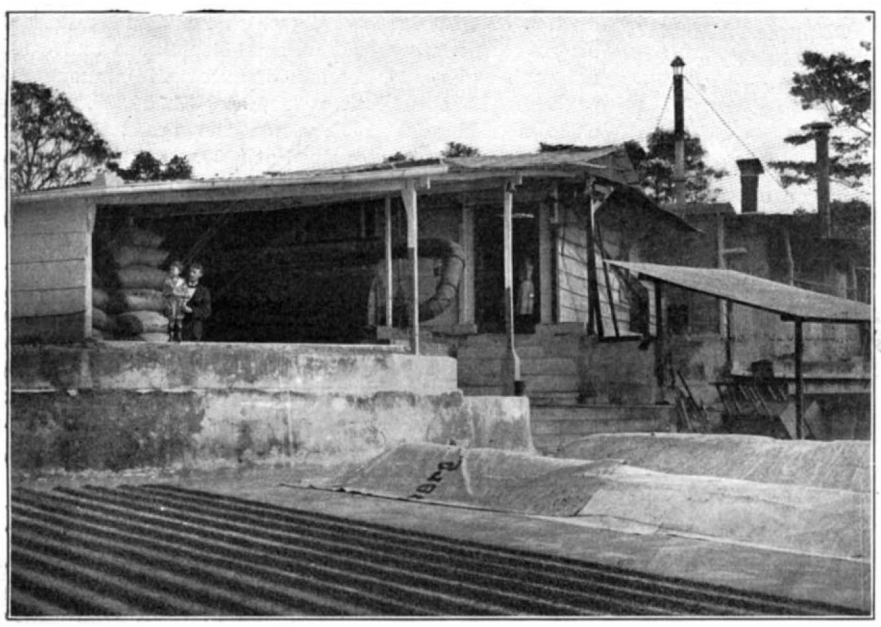
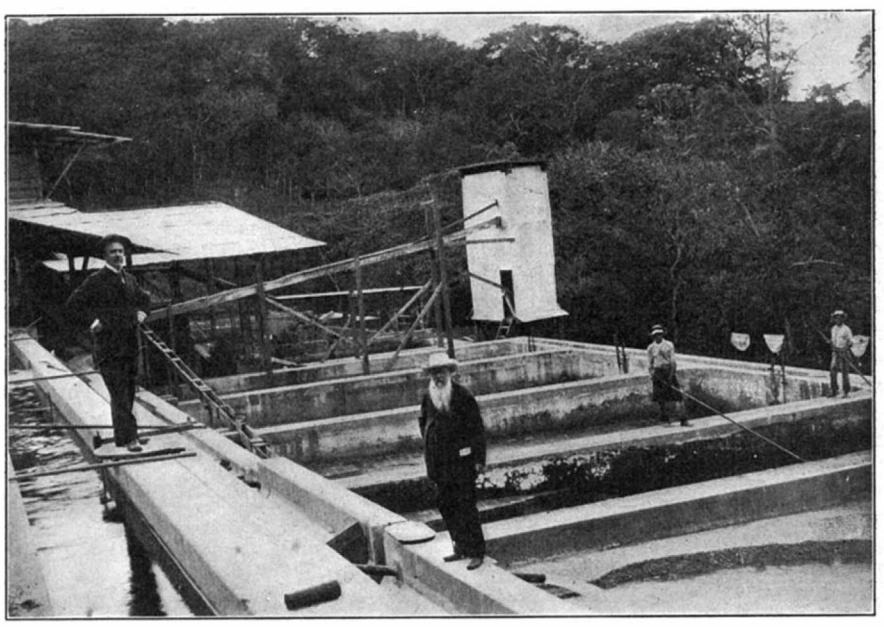


Unloading Coffee in Fruit on Patio.

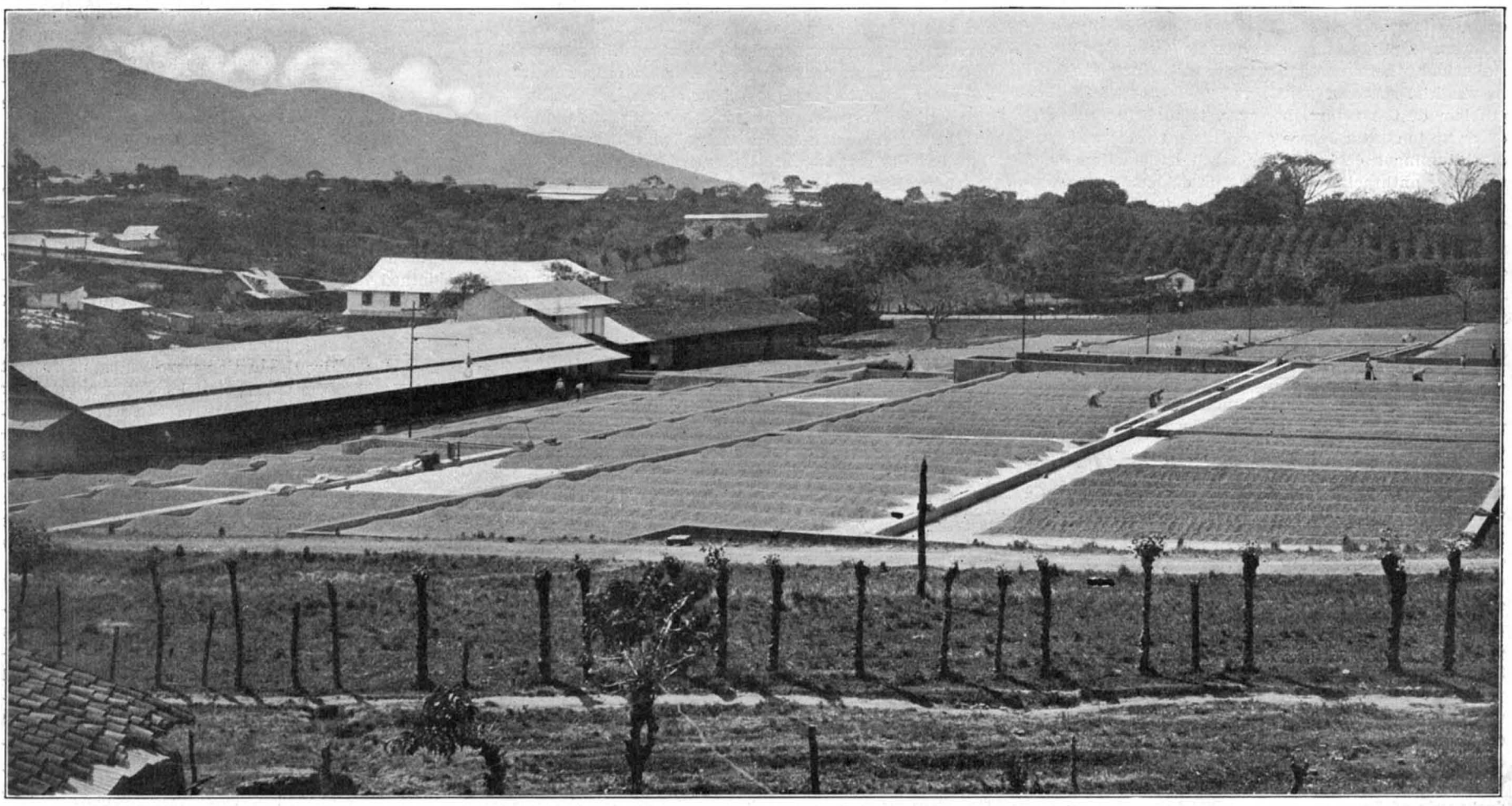
Packing Coffee for Shipment.



Drying Coffee in Sun and in Drying Machine.



Tanks for Fermenting Coffee.



Drying Coffee in the Sun at San Jose.

A TYPICAL COFFEE PLANTATION IN SOUTH AMERICA.—[See page 194.]

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NEW YORK, SATURDAY, SEPTEMBER 17, 1904.

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 ULTIMATE DEVELOPMENT OF THE GAS ENGINE.

It is greatly to be regretted that because of some slight hitch in the arrangements, several large gas engines and producer plants, which were promised by German and French builders for exhibition at St. Louis, have failed to materialize. Had these elaborate plants been installed and shown in operation, as was intended, the exhibit would have been an object lesson whose effect must surely have been far-reaching in this country, where it is not generally understood what vast strides have been made in Europe in the development of the gas-engine industry.

Units of from 3,000 to 6,000 horse-power have been built, and others ranging as high as 8,000 horse-power are under construction. Continental builders have been quick to realize the vast possibilities of the gas engine; and one large industrial concern that is using this form of motor in its establishment, recently informed the American representative who arranged for the gas-engine exhibit at St. Louis, that within a few months he hoped to have not a single steam engine running in its large establishment.

Much progress has been made along the lines of the self-contained gas engine, in which the single unit consists of producer, washer, reservoir, and engine complete; and to such an extent has the development been carried, that plans are now under way for the installation on a marine vessel of a self-contained gas engine plant, in which it is hoped to secure a large economy of fuel with a considerable reduction in weights and space occupied.

Future development of the gas engine must be directed as much to the producer as to the engine itself. There are no fundamental unsolved problems about the former, but in the producer there is a wide field for improvement. The large gas engines to which reference has been made above are running generally on blast furnace gas or some form of producer gas. If the supply of coal for producer work were entirely of the anthracite variety, there would seem to be practically no limit to the development of the industry and the wide range of uses to which the producer gas engine could be applied. It is probable that in a substitution of producer gas engines for steam engine installations, there will be economy all along the line, in weights, space occupied, and fuel consumed. The problem of the future, however, is to bring the producer up to such a degree of efficiency that it will handle bituminous coal with as much satisfaction as it now uses anthracite coal; for it is evident that a producer gas engine that is dependent for its efficiency upon anthracite coal can have only a limited range of usefulness. What is needed is such an installation as can take whatever grade of coal is most accessible. As soon as this problem has been solved, the gas engine will receive the greatest impetus in its history.

ENDURANCE OF WARSHIP MACHINERY IN THE RUSSO-JAPANESE WAR.

The extremely arduous campaign in the Far East is putting the warships of both Russia and Japan to an extraordinarily hard test, and in the case of Japan the propelling machinery, including engines and boilers, is being tried out about as thoroughly as could well be asked.

The secrecy observed by the contestants has rendered it very difficult to obtain reliable information as to just how well the ships are standing the heavy strain put upon them, and much of the evidence that has been published must be received with great caution, being largely founded upon hearsay. The best technical article dealing with the subject, is one that was recently published by our esteemed contemporary, The Engineer, of London. It bears the earmarks of having been written by its own naval expert, who, not long before the war, was given exceptional facilities to visit and describe the principal dockyards of Russia.

According to this authority, the strongest interest centers in the Japanese ships, because of the very severe steaming test imposed by their continuous service on the high seas. Not a single ship of the fleet is able at present to maintain its original speed, though most of the loss is due to foul bottoms rather than deficiency of engines and boilers. Up to the time of her loss, the battleship "Hatsuse" had proved the most efficient steamer, one of her officers having written, a few days before she was sunk, that no defect of any kind had appeared in her motive power, and that her loss of speed from foul bottom was only about half a knot. The most serious falling off of speed was in the cruisers "Asama," "Yoshino," and "Chitose," and the battleship "Fuji," most of which had experienced trouble with their boilers. The armored cruiser "Iwate" was badly hit during the battle of February 9 in the region of the boiler room, but although leakage of the boilers, which are of the Belleville type, occurred, there was no serious loss of speed. The speed of the 22-knot "Asama" has sunk to about 18 knots, and the other cruisers mentioned above, all of which were high-speed vessels, are supposed to be good for about 18 knots. The battleships "Fuji" and "Yashima" have fallen in speed from their original 18 and 19 knots to about 14 knots, the assigned cause being that it is not considered safe to urge their old-type boilers. The battleships "Mikasa" and "Asahi" and the armored cruisers "Yukumo," "Azumo," and "Idzumo," at the time the article was written, were steaming fast and well, the Belleville boilers having given no trouble whatever. The battleship "Shikishima," which is equipped with Belleville boilers, had no trouble in her boiler room, but some slight injury had been done, probably by a projectile, to her machinery. The destroyers had all fallen off greatly in speed under the tremendous strain to which they had been subjected, but the general sentiment was that, bearing the circumstances in mind, the performances of the vessels had been satisfactory.

The big armored cruisers "Gromoboi" and "Rossia" of the Russian navy are spoken of as being in good steaming condition, an estimate that was verified by their escape shortly afterward at the close of the battle in the Corea Strait. The "Retvizan," which, it will be remembered, was torpedoed in the first attack on Port Arthur, had her engines thrown out of alignment by the shock, which also developed leaky tubes in the boilers. It is a surprise to learn that the "Czarevitch" suffered no injury whatever to engines or boilers when she was torpedoed at the opening of the conflict, and also that, although the torpedo hit her rudder, her propellers suffered no hurt. After being patched up at Port Arthur she was able to steam at a good speed, although the terrific hammering she received in the latest engagement cut the speed down to 4 or 5 knots an hour. The cruiser "Pallada" was struck amidship by a torpedo, that passed through the side and exploded partly in the coal bunker and partly within one group of her Belleville boilers. The tubes of the boilers were torn out and twisted into an S-shape. They were subsequently withdrawn, straightened, and replaced, mostly by the ship's own engineers. The battleship "Pobieda" was hit by a mine in the port boiler room. There was a big inrush of water and the fires were put out, but no one was injured. Strange to say, no tubes burst, and the ship returned to harbor under her own steam. The only repairs necessary were to patch up the hole torn in the ship's side by the torpedo. The main engines were quite uninjured. Although in the early days of the war the Russian destroyers were inferior in speed to the Japanese, the hard service to which the latter have been put has equalized matters.

The lessons of the war, as far as the engine room is concerned, are summarized as follows:

First. The impact of heavy projectiles has a strong tendency to affect the alignment of machinery by shock, but has less effect than might have been expected upon boilers, whether of the water-tube or cylindrical type.

Secondly. All small ships, especially torpedo craft, wear out quickly and lose heavily in speed as the result of hard service.

Thirdly. The deterioration of big ships is considerably less; and in the case of vessels which, like the "Idzumo" and "Bayan," were well cared for in the days of peace, the deterioration is very little indeed.

Fourthly. The disablement of machinery by gun fire is quite improbable, the danger being limited to partial injury.

Fifthly. Cylindrical boilers have proved inferior to water-tube boilers of the Belleville variety. The tubes have been easily swept at sea, whereas the ships carrying cylindrical boilers have had to return to harbor frequently for cleaning.

Lastly. It has not proved possible to maintain full speed for any length of time in either fleet, although the "Bayan," on the occasion of her escape from the Japanese, is said to have steamed for nine hours at top speed. One cause of failure has been the physical difficulty of getting the coal from the bunkers quickly enough, whence a lesson is drawn as to the great importance of coal economy.

PRODUCTION OF COAL IN 1903.

Returns made to the United States Geological Survey show that the United States has again exceeded all previous records in the production of coal. The forthcoming report on the country's coal production, which Mr. E. W. Parker, statistician, will soon make, will show that the total output of the coal mines of this country in 1903 amounted to 359,421,311 short tons. This is an increase of 57,830,872 short tons, or 19 per cent, over the production of 1902, which amounted to 301,590,439 tons. The production of 1903 was nearly double that of 1893, and more than three times the output of 1883. The increase of production in 1903 over 1902 was equal to the total production of all kinds of coal in 1878, only twenty-five years ago.

Large and significant as was the increase in the amount of coal produced, the increase in the value of the product was still more noticeable. The value of the coal product at the mines in 1903 amounted to $506,190,733, which, compared with the value of the output in 1902 ($367,032,069), shows an increase of $139,158,664, or nearly 38 per cent. The percentage of increase in value was almost exactly double that of the increase in production—a significant fact which social scientists may interpret as they please.

Of the total production in 1903, 74,313,919 short tons (66,351,713 long tons) represent Pennsylvania anthracite, valued at $152,036,448. This is in contrast to the production of 1902, when the output was curtailed by the prolonged strike in the anthracite regions and reached only 41,373,596 short tons (36,940,710 long tons), valued at $76,173,586. The increase in anthracite production in 1903 over the production of the previous year was 32,940,324 short tons (29,411,003 long tons), or nearly 80 per cent in quantity, and $75,862,862, or nearly 100 per cent in value. The production of bituminous coal (which includes lignite, or brown coal, semi-anthracite, semi-bituminous and cannel coal, and scattering lots of anthracite) amounted to 285,107,392 short tons, valued at $354,154,285, which, as compared with 1902, when the production was 260,216,844 short tons, valued at $290,858,483, shows an increase of 24,890,548 short tons, or a little over 9 per cent in quantity, and of $63,295,802, or a little less than 22 per cent in value.

From this appears that 57 per cent of the total increase in production, and 54 per cent of the increase in value was due to the return of normal conditions in the anthracite fields of Pennsylvania. The average price for a ton of bituminous coal, which is obtained by dividing the total value by the total product, was $1.24 for a short ton in 1903 and $1.12 in 1902. The average price of a ton of anthracite coal was $2.05 in 1903, as against $1.84 in 1902.

Of the thirty States and Territories which contributed to the output in 1903, increased production over 1902 was shown in all but four. Two of those in which the production decreased were among the eastern States, Maryland and Georgia, and two were in the Rocky Mountain region of Colorado and Montana. The greatest decrease was shown by Maryland and was probably due to the largely increased output of Pennsylvania anthracite. Colorado's production fell off only 32,000 tons, notwithstanding the fact that mining operations were seriously affected by labor troubles. There was only one State, Georgia, in which the value of the production was less than in 1902.

Next to the increase in the output of Pennsylvania anthracite the most important gains were shown by West Virginia, 5,679,582 short tons; Pennsylvania bituminous, 4,696,690 tons; and Illinois, 4,267,294 tons.

In order that some idea of the bulk represented by the coal production of the United States in 1903 may be obtained it might be stated that, if the entire production were loaded on freight cars with a capacity of 30 tons each, the trains containing it would encircle the globe at the Equator about three and one-third times. If the entire production were loaded on freight cars in one day, the trains would occupy one-quarter of the entire railway trackage of the United States. Taking an average of 30 cars to a train, it would require sixteen times as many freight locomotives as there are in the United States to move this tonnage in one day. If spread over the surface of Manhattan Island, which has an area of 22 square miles, the entire island would be covered to a depth of nearly 25 feet.

The Paris-Lyons Mediterranean railroads have introduced automobile trains upon their service between Paris and Montereau, a distance of 45 miles. The carriages are each 36 feet in length by 8 feet wide, and 9 feet high. The first-class compartments have accommodation for 12 passengers and the second class for 24 passengers. Twelve more passengers can be accommodated upon a glazed platform at the rear of the carriage, while the engineer has his position in front. Each automobile costs $8,000, as compared with $22,000 for an ordinary steam locomotive.

NEW YORK MEETING OF THE SOCIETY OF CHEMICAL INDUSTRY.

For the first time in its history, the Society of Chemical Industry has met in America. In the Gymnasium of Columbia University the last meeting was called to order on September 8 by Sir William Ramsay, the retiring president of the society. Following the usual custom, Sir William delivered the annual address, selecting as his subject "The Education of a Technical Chemist." The more striking portions of the address were those dealing with Sir William's ideal system of chemical instruction, of which the following is an abstract. The complete text of the paper appears in the current issue of the SUPPLEMENT.

"I have wondered," said Sir William, "if it might not be possible to establish a training school for technical chemists somewhat on the following lines: To start an association having for its object the encouragement of invention, each member of which would subscribe a certain sum for the erection of buildings and plant. There would need to be a number of isolated buildings, and a considerable collection of stock plant of a small scale—stills, tanks, evaporating pans, filter presses, vacuum filters, centrifugal machines, crystallizing vats, and so on. The work should be furnished with steam and electric current. Such a syndicate might let it be known that they were willing to make arrangements with inventors, or with syndicates which had secured the patents of an invention, or secured an option on such patents. The superintendent or professor should be provided with a staff of assistants, who would be each in charge of one building—that is, of one operation. Students would be admitted for an appropriate premium.

"Supposing an idea to be brought to the notice of the directors, they would consult as to whether it should be accepted or not. If accepted, then the share of profits would be arranged with the patentee, should it prove successful. It would be committed to the charge of one of the staff, who would first work it out in the laboratory with the aid of a staff of students. If it then seemed feasible, it would be tried on a comparatively small scale, dealing with hundredweights, in one of the special buildings, those students who had investigated the process in the laboratory sharing in the larger scale operations. The surmounting of difficulties in the transition, the perfecting of the process, the making of working drawings of the requisite plant, would afford the best of all training to students, and in case the process proved a commercial success, these students who had helped to elaborate the process would be naturally the first to obtain employment in works, should they be erected. At the same time, manufacturers would naturally be anxious to obtain the services of men trained in so good a school.

"The education of a chemist (and the word 'chemist,' of course, includes the qualification "technical chemist") must be conceived in the sense that it consists in an effort to produce an attitude of mind rather than to instill definite knowledge. In short, it is the inventive faculty which must be cultivated.

"My contention is that most of the lads who enter a chemical laboratory are able to receive some inspiration, or to have a latent inspiration developed, which will fit them to become inventive chemists.

"Now, how can this be brought about? The answer is perfectly simple: by offering them examples. Every teacher in the laboratory, from senior professor to junior assistant, must be engaged in research, and most important of all, they must not be reticent, but willing to converse freely on their problems.

"Above all, not too much teaching. The essence of scientific progress is the well-worn method of trial and failure. It is simply horrible to think of the travesty of teaching in vogue in some of our colleges, where everything is provided, and where the students add one solution to another by word of command and record their results in special notebooks constructed for the purpose. What do they learn? To obey? That should have been taught in the nursery. Manipulation? Manipulation consists in constructing what is required, not in using what is given. I had rather see a youth commit the Æneid to heart than carry out such time-wasting soul-destroying routine operations. The first may result in a stronger memory; the second is fatal to all originality.

"And now let me discuss a question which has not given difficulty in America, I understand, but which has greatly retarded the advance of knowledge and research in England. I refer to examinations. It may well be introduced here, for, it may be asked, Should only a graduate be recognized as worthy to occupy a junior teaching position? To this I would reply: Let the choice be free. The older I get the less I believe in university degrees as a test of capacity. Perhaps the reason is the manner in which degrees are awarded in England; the degree follows on one, or at most two examinations, often by men who know the candidate only as a number and whose idea of examination often is to set questions to trip the candidate, and not to draw out what he can do. Indeed, it raises the question which I have mentioned earlier in this address. The examination is so contrived as to elicit what a man knows rather than what he can do.

"The pernicious system of competitive scholarships and fellowships, instead of eleemosynary support given to the necessitous and deserving youth, has also contributed much to the debasement of the scientific spirit; for it has early implanted in the young mind the idea that to outrun his fellows and to work solely for a money reward are the ends to be aimed at, instead of the joy of the exercise of a divine gift and the using of that gift for the benefit of man. It is true that to earn money is a necessity; it is in no way a wrong aim; but it is not the chief aim, and money should be earned as a reward for useful labor, not for success in scholastic competitions.

"In conclusion, let me make one more remark. It is that the scientific curiosity of to-day often becomes the trade necessity of to-morrow. The purely scientific investigator who is free to follow indications of no apparent commercial import has not infrequently made discoveries of a radical nature, which have entirely changed some particular industry. I do not recommend the one to the exclusion of the other; both are best, and both are best attained by an intimate association between the universities and the chemical works. The investigator often learns much by the study of industrial processes. The chemical manufacturer who is keenly alive to his own interests will not fail to keep himself in touch with every discovery, however little it appears to be connected with his own industry.

"To quote from the 'Rules of Political Conduct,' written for the people of Japan 1,300 years ago: 'The imperative duty of man is to sacrifice his private interest to the public good. Selfishness forbids co-operation, and without co-operation there cannot be any great achievement.'"

It was decided to hold the next meeting in London in the latter part of July. Sir William Ramsay then presented the society's medal to Prof. Remsen for "conspicuous service rendered to applied chemistry by research, discovery, invention or improvements in process."

LAUNCH OF THE FIRST TURBINE-PROPELLED LINER FOR TRANSATLANTIC TRAFFIC.

The launch of the vessel which is destined to be the pioneer of the trans-Atlantic turbine-propelled liner, and thus mark a new era in the history of navigation, was recently carried out at Belfast, Ireland. This ship, which is named the "Victorian," has been built for the Allan Steamship Line, plying between Glasgow and Canada, by the firm of Workman, Clark & Co. The vessel was originally designed for propulsion by the ordinary reciprocating engines, but at the time the contract was undertaken by the shipbuilders, the efficiency of the application of the steam turbine to smaller passenger craft, such as is engaged upon the Clyde and across the English Channel, had so conclusively asserted itself, that it was decided to install this system of propulsion in the latest addition to the Allan fleet. Some slight modifications had to be carried out in the designs of the boat to accommodate the turbines to the best advantage, but these alterations have appreciably increased the beauty of the boat, which has somewhat finer lines and is more handsome than the usual boat of this class.

The vessel measures 540 feet in length over all; beam, 60 feet; depth, 42 feet 6 inches; displacement, 13,000 tons. The boat has eight spacious decks, of which six will be for the convenience of the passengers. The captain's bridge is 80 feet above the keel. There is accommodation for 1,300 passengers; that for the first-class being placed amidships. The first-class dining rooms extend the full width of the boat, and there is seating accommodation for 400 passengers.

The "Victorian" is divided into eleven watertight compartments, and three of the decks extend from stem to stern and are made of steel throughout. The cellular double bottom as well as the peaks are arranged for carrying the water ballast.

The turbines with which the liner is to be propelled are the largest that have yet been constructed. They are to be of the Parsons marine type, and they have been erected at the shipyard of the builders of the vessel by arrangement with the Parsons company. There are five of these huge turbines, three utilized for the forward propulsion of the vessel, and two for reversing. The power will be transmitted through three propellers. The center forward turbine is the high-pressure, and the ones on either side low-pressure turbines. The reversing machinery is so arranged that it may be employed for driving the vessel astern at full speed, either together or separately. Steam is generated by forty-eight furnaces.

The vessel's speed will not be excessive, considering the speed that is possible with this type of turbine, only 17 knots per hour being contracted for. The "Victorian," however, will be the fastest vessel engaged in the Canadian service. It is anticipated, however, that the vessel will prove noiseless and steadier in the seaway, even when exerting her maximum speed, than one fitted with the general type of reciprocating engines. The "Victorian" is to be employed for the first-class mail service of the Allan Line, and it is expected that the duration of the passage will be reduced by nearly one day.

The vessel has been designed according to Admiralty requirements, and in case of war will be available as an auxiliary cruiser or transport. When engaged in the latter service, she will have accommodations for 3,000 troops.

The erection of the "Victorian" is being followed with the deepest interest by all marine engineers, since as it is essentially an experimental vessel, the results attained will be valuable in the future estimation of the possibilities of this type of propulsion for such traffic. For, although the steam turbine has demonstrated its efficient application for the propulsion of small passenger craft, its adaptability to the heavier demands of ocean requirements has yet to be established. The Allan Line, however, are confident of the success of their policy, and have another vessel of approximately the same dimensions, tonnage, and speed as the "Victorian" well advanced on the stocks, which is also to be turbine-propelled.

A TEST OF THE DOENVIG GLOBE.

A practical test in the open sea was recently carried out with a life-saving globe devised by Capt. Doenvig and which was fully described in a recent issue of the SCIENTIFIC AMERICAN. The globe containing three men was dropped overboard from the steamship "Ragni" in the North Sea, midway between Yarmouth and the Hook of Holland. The globe was launched from greased boards hung over the steamer's side. The sphere entered the water with a splash and disappeared, but quickly came to the surface again and bobbed about like a cork. In accordance with prearrangements the inmates anchored the globe and cooked their first meal within. The sphere was provided with two months' provisions and 20 gallons of water, while the voyagers also carried scientific instruments, fishing lines, etc. The steamship continued on its voyage to England and the buoy finally drifted eastward with the wind.

The globe drifted about for forty-eight hours. During a part of the time the inmates operated the special propeller with which it is equipped in order to maintain their course eastward toward the coast of Holland, and by this means contrived to attain a speed of 2½ knots per hour. The globe carried a Norwegian flag by day and a lantern by night to denote its position. Two days after being cast adrift it approached the Terschelling coast, and apprehending that the globe might drift seaward again, the passengers decided to land, but ultimately changed their plans and induced a trawler to tow them to Yminden. The trial was a complete success, and was not marked by a single mishap of any kind. Two of the passengers suffered severely from sea sickness, owing to the severe manner in which the sphere rolled about. At times, however, it was very steady and floated evenly. Had it contained greater weight in passengers or ballast it would have been much steadier.

THE CURRENT SUPPLEMENT.

In commemoration of the convocation of the Society of Chemical Industry in this city, and of the visit of the famous English chemist, Sir William Ramsay, to this country, the SCIENTIFIC AMERICAN SUPPLEMENT gives the address of Sir William on "The Education of a Technical Chemist," accompanying the text with a full-page portrait, which was especially taken for us in Prof. Ramsay's laboratory in England. Other articles of interest are those by Herman von Schrenk on "The Shapes of Railway Ties." Mr. von Schrenk has given the subject considerable study and thought. Mr. Emile Guarini describes a new system for securing secrecy in wireless telegraphy, which seems to contain much promise. His article is well worth reading by those who have followed the development of wireless signaling. Dr. Max Heim writes instructively on "Natural and Artificial Perfumes." "Some General Rules for Staining Wood" is the title of an article of practical value. In accordance with our promise to present in the SUPPLEMENT an article in each number describing the St. Louis Fair, we publish a complete description of the vast Exposition Palaces, the text being illustrated with handsome pictures especially taken for this issue. Prof. A. Rateau, well known for the part he has played in the development of the steam turbine, makes some suggestions on "Steam Turbine Propulsion for Marine Purposes." Readers of the SCIENTIFIC AMERICAN and of the SUPPLEMENT are doubtless familiar with the new storage battery Thomas A. Edison has invented. It seems that Jungner is also the inventor of a battery based on precisely the same principles. The German inventor claims priority over Edison. Some day the controversy must be fought out in the courts. In the current SUPPLEMENT will be found a very complete description of the Jungner cell, together with the history of its development.

THE JUNGNER ALKALINE ACCUMULATOR.

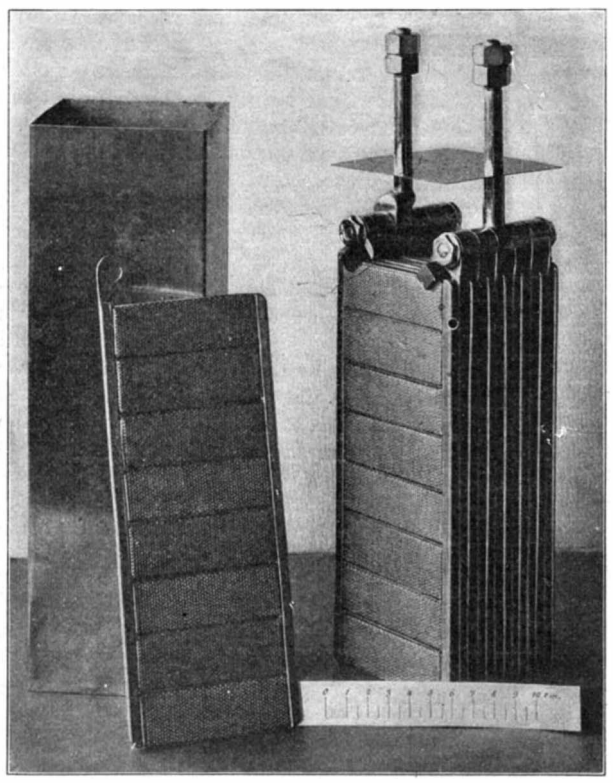
Although the name of Jungner has been heard occasionally in connection with the new type of storage battery which Mr. Edison has perfected and placed on the market in this country, but few are acquainted with his claims to recognition as the original inventor of the alkaline accumulator with unchangeable electrolyte. A complete statement of these claims, as well as an illustrated description of the development of the Jungner battery, will be found in the current SUPPLEMENT.

The illustration we present herewith shows the appearance of the plates and jar of the latest type of Jungner cell, such as is now being manufactured in Sweden and Germany. The plates and pockets of active material are fewer in number than those in an Edison cell, and the pockets are thicker and arranged horizontally instead of vertically. The construction of the plate is also different. Instead of expanding numerous pockets in a thin sheet-steel grid, Jungner uses larger and fewer pockets placed in a frame and running the entire width of the latter. The fewer plates would perhaps tend to make less complication and chance of short-circuiting, but otherwise they have no special advantage; and the more numerous and thinner briquettes of active material employed in the Edison cell, together with the smaller space between plates, evidently is advantageous from the fact that with this cell an average working voltage of 1.24 is had, while with the Jungner cell the mean difference of potential is 1.15. The following are the specifications of the smallest sized cell made by the Kolner Akk. Werke, at Kalk, near Cologne: The cell has five positive plates of nickel and four negative plates of iron. Its capacity at a three-hour rate of discharge is 60 ampere hours, and at a ten-hour rate, 68 ampere hours. The mean voltage on discharge is 1.15 volts. A 30 per cent solution of caustic potash is used as electrolyte. The size of the containing jar is 300x 84x72 millimeters (11.81x3.30x2.83 inches).

We refer the reader to the article in the SUPPLEMENT for further particulars regarding this new battery, which is said to be practically indestructible and to be capable of being manufactured at no greater cost than the best lead batteries now on the market.

A RECORD TRANSCONTINENTAL AUTOMOBILE TRIP.

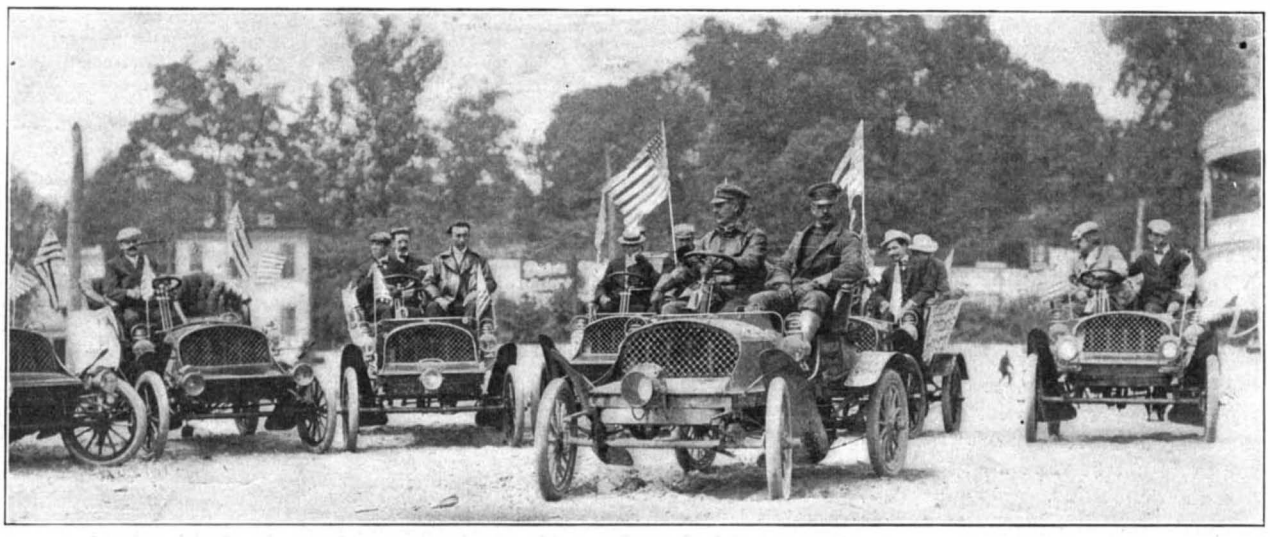
The best previous record for an automobile running under its own power overland from San Francisco to New York was beaten by 28 days upon the arrival in this city, on September 3, of Messrs. L. L. Whitman and C. S. Carris in a 10-horse-power, four-cylinder, air-cooled Franklin runabout, upon which they had made the 4,500 miles in 33 days without any serious mishaps. The start was made at 5 P. M. of August 1, and the arrival in New York took place at 12:30 P. M., of September 3. The first and last days' runs were short ones of only 50 miles, and it is probable that if the tourists had traveled a little longer on these and some of the other days when the roads were fairly good, they could have reduced the record to exactly thirty days, or, in other words, have cut it cleanly in half. That this was quite possible is shown by the fact that a record trip from St. Louis to New York, a total distance of 1,300 miles, was completed on September 6 by a Franklin machine driven by A. C. Halsey and W. K. Seaman in 5 days and 2 hours, over roads that were in many places extremely muddy, and part of the time through rain. That this particular make of air-cooled motor car was speedy and had endurance, was demonstrated on the track and in the New York-Pittsburg test of last October; but that it could so successfully break all records in a long transcontinental trip over roads, trails, mountains, and across trackless wastes of alkali and sage brush, was something that came as a surprise to all automobilists. The reasons for the success of the record-breakers may be found in the fact that Whitman had crossed the continent before (he made the trip last summer in 73 days with an Oldsmobile) and he thus was familiar with the route and with the conditions to be encountered. Secondly, very little rain was met with, and although the roads were extremely dusty, there were no muddy stretches to impede the progress of the little car. Thirdly, the car itself was very reliable, and, save for the chain breaking once, besides a couple of punctures and a broken spring the last day, there was no trouble in its operation. The air-cooled motor worked perfectly, both in the intense heat of the alkali desert and when running on the low gear in climbing the mountains. Samples of what it passed through in these places can be seen in two of our illustrations, while the third picture shows the machine as it entered New York, escorted by some similar machines.



JAR, PLATE, AND ASSEMBLED ELEMENT OF THE JUNGNER ALKALINE STORAGE BATTERY.

The route followed this time was across California to Wadsworth, Nev.; thence to Battle Mountain, and then to the northern part of Utah, passing around Great Salt Lake, and on to Ogden, which was reached in 10 days, cutting the previous record exactly in half. From Ogden the tourists went to Allen and Laramie, Wyo., and thence to Denver, Col., which was reached in 16½ days, as against 30 days for the best previous record. From Denver the route lay across Nebraska to Omaha, and through Iowa and Illinois to Chicago. The 3,300-odd miles to the Windy City were covered in 25 days, or less than half the time of Fetch's record with the Packard (51 days). Eight days were consumed in reaching New York, although the above-mentioned record of another Franklin from St. Louis to New York—some 300 miles further—in 81 hours 38 minutes 17 1-3 seconds actual running, proves that this record could easily have been brought down to the one-month mark.

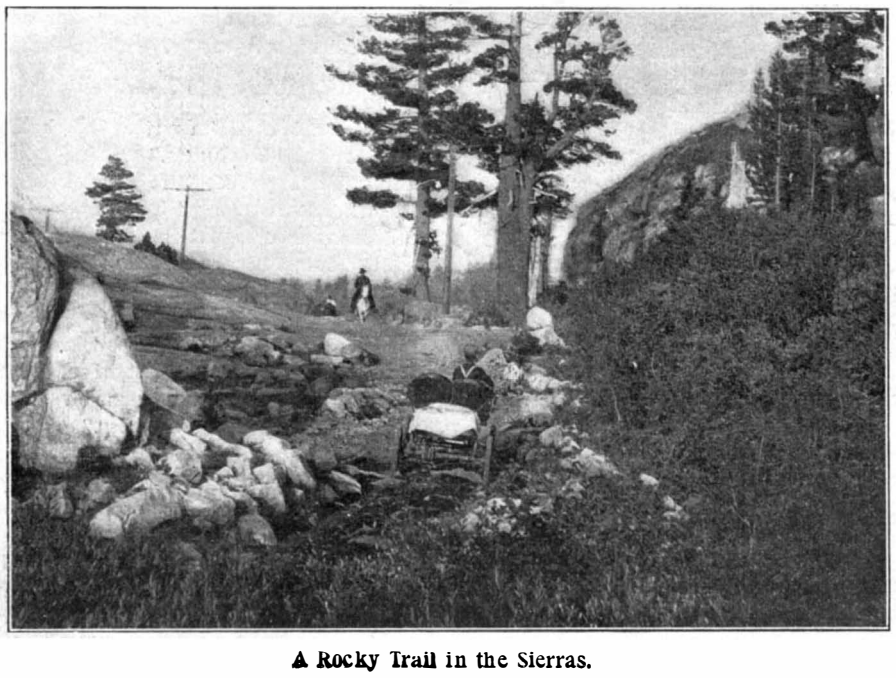
No motor could be submitted to a more severe test than the little four-cylinder air-cooled one on the transcontinental Franklin car underwent, and this test has again proven the entire practicability of the small multi-cylinder air-cooled motor, even when a fan is not used to cool it.



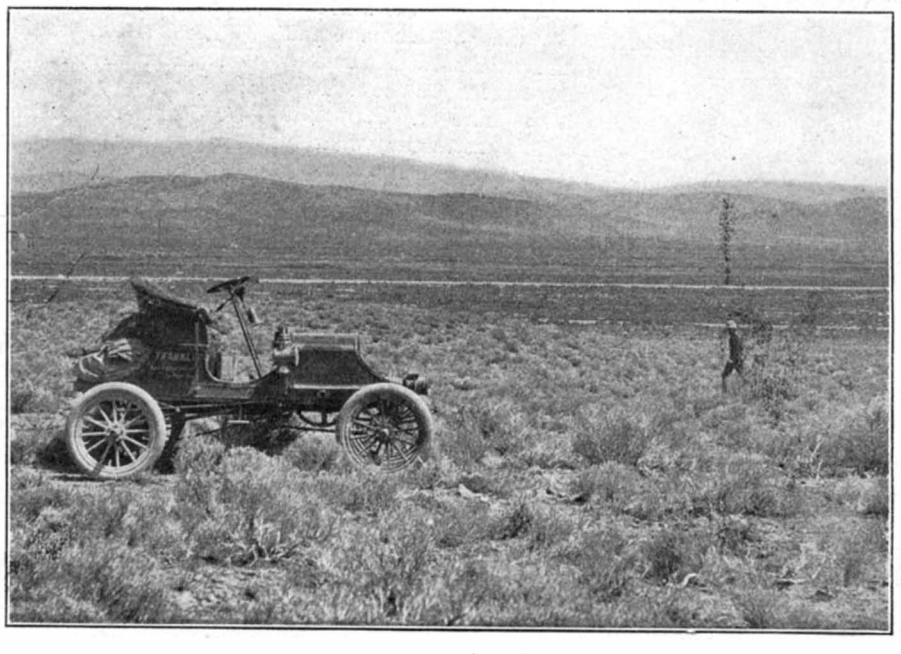
The Arrival in New York, Escorted by Some Similar Cars.

Specimens from the Antarctic.

The first consignment of specimens secured by the "Scotia," of the Scottish Antarctic expedition, has arrived in Edinburgh together with several of the scientific instruments employed during the voyage. The specimens, which were of an animal and oceanographic nature, were contained in 200 barrels and cases. The larger specimens upon their removal from the cases were immersed in specially-prepared zinc tubs containing methylated spirit and provided with rubber-rimmed lids, thus constituting an excellent medium for preservation. The classification of the specimens secured by Dr. Bruce will occupy several years.



A Rocky Trail in the Sierras.



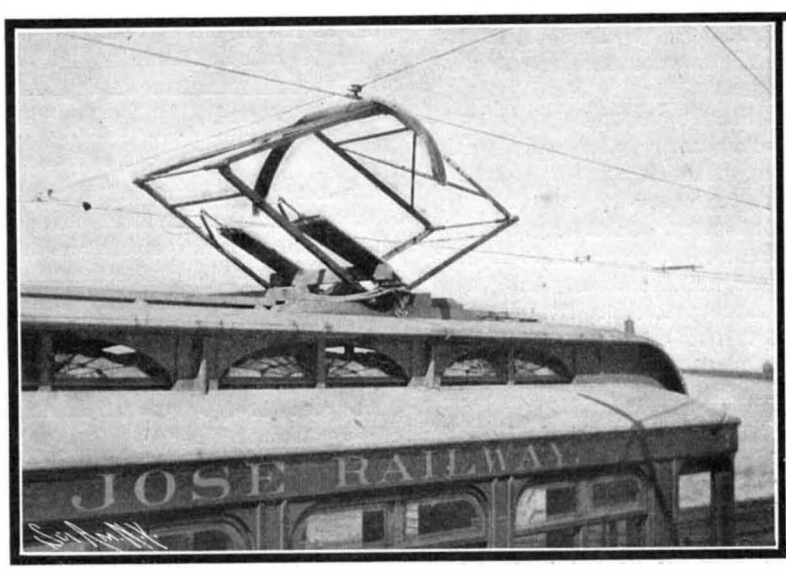
A Sample of Alkali Desert.

THE RECORD TRANSCONTINENTAL TRIP OF AN AIR-COOLED MOTOR CAR

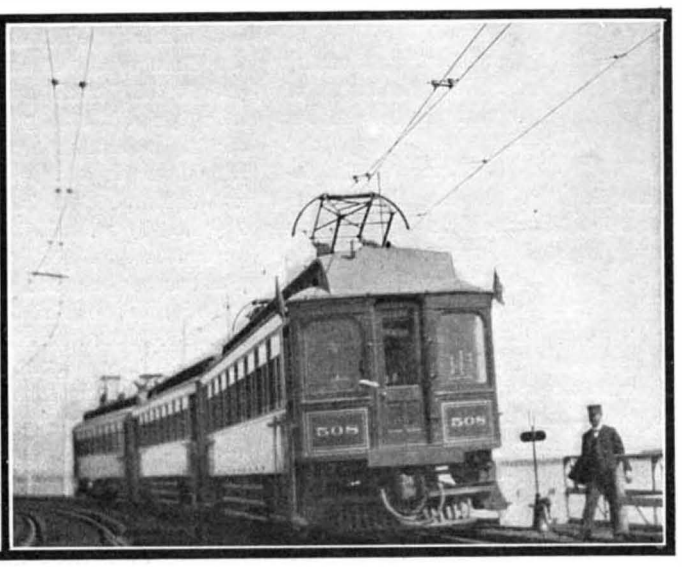
A TROLLEY FOR HEAVY MULTIPLE-UNIT ELECTRIC TRAINS.

BY HERBERT I. BENNETT.

Electric railroading on the Pacific coast has been progressing at a more rapid rate than in any other portion of the United States during the last two years. This advance has not been along the well-established practices for city lines alone, but much has been done in extra-heavy traffic for suburban service. The conditions met with have caused the engineers connected with these enterprises to do a great deal of original and pioneer work. Probably the most unique and absolutely successful device that has been developed is the trolley in use on the San Francisco, Oakland & San Jose Railway, commonly known as the Key route, which was designed and recently patented by Mr. John Q. Brown, the engineer in charge.



The Roller Trolley as Mounted on a Car.



Multiple-Unit Train Fitted With Roller Trolleys.

AN IMPROVED ROLLER TROLLEY FOR HEAVY ELECTRIC TRAINS.

The conditions met with were most exacting, some of which we will mention here. A third-rail system was out of the question, as part of the road passed through streets of various towns and cities, including Oakland and Berkeley, with a combined population of 100,000. The ordinary trolley pole and wheel was entirely unsuited for the work, because at high speed the wheel would leave the wire, the direction of trains could not be reversed, such as in switching, without serious delay in reversing the trolley poles, and most important of all, the heavy currents could not be collected without severe arcing at point of contact. This road operates eight-car trains, weighing, approximately, 350 tons, and at speeds as high as fifty miles per hour, which require at times, approximately, 2,500 to 3,000 amperes to be collected from the overhead conductor. A device was required that, in addition to meeting the above conditions, would operate at high speed on curves without leaving the wire in any direction. Also it must have a range of not less than six feet in height for passing through subways and over surface railroad crossings. These requirements have all been more than met in this device, as it has been operating perfectly for one year, and is a great success.

It has been found that it simplifies the overhead construction greatly, doing away with all trolley frogs and switches except at right-angle crossings, where a simple crossing of special design is used.

The wear on the trolley wire is less than that caused by the ordinary wheel, and the life of the roller which is used is not known, as the original rollers are still in service. These wear to a bright smooth surface, instead of being corrugated or pitted, as was expected.

The device is practically noiseless when operating at any speed, owing to the fact that the roller is packed with non-resonant matter to destroy the vibration.

In Fig. 1 the trolley is shown in its normal condition upon the car. As readily noted, it consists of a double diamond frame of angle iron made up of four conjoined frames. These are connected on each side by elongated joints to give stiffness, while at top and bottom the frames terminate in segmental gears. The gears at the bottom cause the side frames to move in unison, while the gears at the top keep the guards always in a vertical position, as shown. The roller is carried at the top on a shaft, the ends of which are fastened rigidly in a casting to which the guards are secured and on which pivot the segmental gears. The roller is made of 24 inches of 5-inch non-arcing metal tubing with hubs in each end, which have graphite bushings forming the bearing. These bearings are lubricated with oil carried in a cavity in the hub. The guards, which are essential to the satisfactory operation at branch-off wires, are made of sheet steel pressed into the required shape. The arrangement of the tension springs, which keep the roller in contact with the overhead conductor, is worthy of notice. The springs are in practically the same plane as one side of the bottom frame, and secured as shown. This arrangement gives practically a uniform upward pressure on the roller for all positions of the trolley wire, those now in use operating with a pressure of 24 pounds.

Fig. 2 shows a three-car train at a branch track, the trolley having picked up the branch-off wire. It also shows that two trolleys are used on each train of two or more cars, as such an arrangement always insures a continuous and low-resistance circuit to the motors.

The Key route has twenty-six of these trolleys in use, and one other road has arranged to install fourteen.

THE MALCOTTI TELECRYPTOGRAPH FOR TELEGRAPHING UPON TELEPHONE LINES.

BY EMILE GUARINI.

To develop the telegraph and put it within reach of everybody, to install private lines for the use of the public, of administrations, and of business houses, and even to create, by this method of communication, a valuable auxiliary to the telephone — in a word, to popularize it as well as the latter—is a question that seems to be the order of the day, to judge by the interest that the daily technical press is taking in the subject.

We know that one of the weak points of the telephone is that it leaves no trace of the communications exchanged, and is therefore incapable of receiving in the absence of the subscriber; and that another is that it in nowise assures the secrecy of such communications.

In England, Italy, and France, to speak of these countries alone, this inconvenience has given rise to frequent complaints, inquiries, and lawsuits.

But it seems that such difficulties have finally been obviated, since almost simultaneous announcements have been made of the advent of several apparatus of more or less recent invention, to which the journals attribute characters nearly in common, and the accounts of which would almost lead us to believe that they write or print communications simply spoken in the telephone. At Brussels it is the telecryptograph of Engineer Malcotti, at Berlin the teletype and the Heljes apparatus, and elsewhere the Gruhu telautograph, the teledactylograph, etc., without counting the new systems of telegraphy and telephony with which also the press has for some time been occupying itself. With this true chaos of new inventions confronting us, it will perhaps prove of interest if we present a summary of the true state of the question, of which the great importance must not be forgotten. If it is desired to extend the use of the telegraph, this can be done either by installing special private lines in the principal cities or else by using telegraphic apparatus in connection with the telephones upon telephone lines that already exist. These two problems are substantially different, for, although some regular telegraph system may be made to solve the first, this is not the case with regard to the second. The apparatus derived from the Hoffmann type, installed at Berlin by means of a special line having a central teletypic office, is an example of the first case, as is also the Heljes, a system derived from the Wheatstone and Hoffmann, and which an effort is now being made to introduce. This latter is a simpler apparatus than the preceding, and, since it operates by means of a magneto, it may prove very useful to the army as well as in the operation of railways, and for private telegraph lines. Large business houses and administrative offices may have need of a printing telegraph apparatus for communicating with each other; but it may be seen that such a necessity is rather relative, especially when we think of the prejudicial dualism that might occur between the

Fig. 1.—The Apparatus Complete in its Original Form.

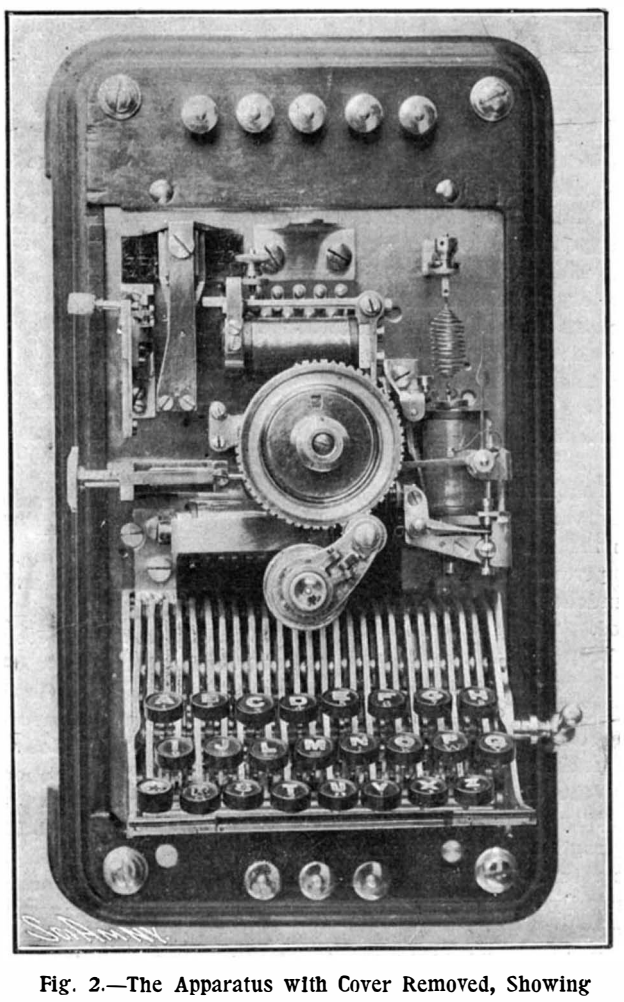


Fig. 2.—The Apparatus with Cover Removed, Showing Interior Mechanism.

THE MALCOTTI TELECRYPTOGRAPH FOR TELEGRAPHING ON TELEPHONE LINES.

To Secure Fulton's Birthplace.

An effort is being made to secure the house in which Robert Fulton was born, and in which he lived for a great many years, at Lancaster, Pa., that it may be preserved in its original condition. The house stands to-day just as it did when the inventor of the steamboat resided in it.

two services if certain persons had the telegraph and others the telephone. This would make it necessary to have both and to pay a subscription to the two lines separately. This is why, without mentioning other objections, it would seem that private telegraphy by independent lines does not as yet represent the ideal from the viewpoint in question, aside, of course, from special applications such as railways, for war purposes, etc.

It is, therefore, from this point of view, pleasing to learn that an Italian electrician, M. Malcotti, of Rome, has been studying this question since 1901, but with the idea of devising a magnetic telegraph for use upon railways. This he finally succeeded in doing by means of the Hiljes apparatus above mentioned. But, subsequently, his attention became specially directed to a study of the application of the telegraph to telephone lines, which seemed to him to be of the most interest. After an examination of the question, he became convinced that it was necessary that the apparatus devised for this purpose should answer the following conditions: (1) That it should be applicable to any telephone installation whatever, even one with a central battery, without requiring any change or interfering with the service; (2) that it should nullify the danger of another apparatus interfering with the correspondence exchanged, and, at the same time, assure the secrecy of the latter; (3) that it should respond to the exigencies of an extensive exploitation, and that the net cost of installation should be small.

Is it possible for existing telegraphic apparatus to fulfill such conditions? It seems not, and the reason is that the telephone installations are based on two different systems, viz., that with individual microphone batteries at the residences of the subscriber and that with a central battery, which is known generally as the "common energy system."

In the first case, the important point is to so arrange conditions that the telegraphic currents shall have no influence upon the central exchange communicators which signal the termination of a conversation and which must be actuated solely by the call current. When the line consists of but a single wire, it is impossible to do this with any kind of telegraph apparatus. But if the line consists of the usual two wires, these can be used in parallel and the ground employed for the return. This is feasible if the central exchange is isolated. Does this system make necessary any alterations at the central exchange? A case where changes are necessary is exceptional. Besides, the common energy system with central batteries is obtaining a firmer footing every day because of the advantages that it presents. And how is it possible to install telegraphic apparatus like that mentioned upon one of these lines? It must be noted that an ideal apparatus should be capable of operating with any sort of installation, not only to make sure of an extensive exploitation, but also to permit of a modification of the latter in measure as the profits and needs of the service increase.

The problem remained unsolved until the apparatus devised by M. Malcotti, and called by him the "telecryptograph," made its appearance to surmount, it is claimed, all difficulties. This apparatus, which is said to have given satisfactory results during the course of some private experiments in Italy, and which is to be tested ere long upon the principal telephone lines of America and Europe, has, up to the present, been described in too incomplete a manner to allow of a very accurate idea being formed of it. It is, upon the whole, a secret printing telegraph, as its name indicates, and the distinguishing feature of the system is that it operates in the very same manner as the telephone, or by currents that do not disturb the central exchange, and which permit, therefore, of installing the apparatus independently of the telephone systems everywhere employed. The first condition mentioned above is thus entirely realized, as is also that of secrecy. In fact, it is possible to attune two apparatus to an agreed upon figure, or note, so to speak, so as to prevent any other apparatus from catching the communication exchanged. If a communication be transmitted in the absence of a subscriber, his apparatus not being attuned, the telegram will be received, but registered in an undecipherable manner. Upon his return, however, he can decipher the message automatically because he knows the cipher agreed upon. Transmitting in cipher, however, is merely optional, as it is possible to transmit, even in a legible manner, according to the usual process. It will be seen, then, that secrecy can be guaranteed while the communication is passing over the line wire to the receiving station, and that this guarantee is as perfect, even, as that offered by a closed letter.

It is not necessary for the central exchange to install the telegraphic apparatus, inasmuch as there is nothing to prevent two subscribers in correspondence from being called by "central." In a word, the apparatus does not interfere with the service. This is an important point.

The telecryptograph, therefore, would seem to solve the problem completely. But will it answer the practical exigencies of use with as much success as is asserted? This is yet to be seen, and it will prove of interest to know the details of the system, which we hope to illustrate some time in the near future. In the interim, we illustrate, in Fig. 1, the apparatus of the first type, which the inventor has greatly improved and transformed. It consists of a 5½x9½-inch box containing the entire transmitting and receiving mechanism. The apparatus prints on a paper ribbon and is actuated by means of a ratchet mechanism operated electrically, the necessary current being supplied by a small local battery. On the right of the apparatus (see Fig. 2 also), there is a sort of key that serves for attuning, as we have already explained.

The recent model is more practical. At the sides of the keyboard unwind two paper ribbons, upon each of which are printed in small and very legible characters the dispatches received and a copy of those sent, in such a manner that they can be distinguished from one another even should they be cut from the roller. The apparatus, which is very simple, is secured to the telephone. A spring that replaces the local battery sets in motion the apparatus, and it is possible to receive and transmit at the same time with or without secrecy.

Science Notes.

From experiments carried out the following conclusions are drawn by R. J. Strutt: (1) A radio-active gas or emanation can be obtained by drawing air over hot copper, or by bubbling it through hot or cold mercury. (2) By repeated circulation through mercury very considerable activity can be obtained, of quite a different order from that of metals as ordinarily observed. (3) The mercury emanation deposits radio-active matter on the walls of the vessel containing it. This deposit remains after blowing out the gas, and possesses at first perhaps one-sixth the activity of the latter. This induced activity falls to half value in 20 minutes. (4) The emanation itself decays in activity according to an exponential law, falling to half value in 3.18 days.

M. Blondlot now gives some additional information regarding the heavy emanation which he found to proceed from different bodies. This emanation possesses weight and falls downward by gravity. It acts almost like a stream of water proceeding from the substance. A silver coin is generally used, but if it is rubbed clean the emanation ceases entirely. It is then sufficient to heat it to 100 deg. C. in the air for a few minutes. When cold it now gives off the rays as before. The same holds good for pure silver, copper, mercury, iron, zinc, and bronze coins. Lead is an exception, and when freshly cleaned it gives off the emanation. On the contrary, after tarnishing, like lead pipe, it no longer acts. All the liquids he tried were active—water, salt water, pure sulphuric acid, glycerine, turpentine, alcohol, and in general all odoriferous liquids. The inactive bodies are platinum, iridium, palladium, gold, dry glass, fused sulphur, etc. M. Berthelot thinks that the emanation is not due to the metal itself (or other body) but to a very slight chemical action which is produced at the surface. The action of liquids, whose vapor tension is never absolutely zero, and of odoriferous bodies might be due to the formation of volatile compounds. It will thus be of interest to take up the question from a chemical point of view.

A cemetery belonging to a garrison of Longobards has been found near Ascoli on the Tronto at an important pass across the Apennines. The site of the fort is the top of an island of rock now occupied by a little hamlet called Castel Trosino. All the warriors were laid with their faces to the east. Near the head was found a comb made of horn or bone and a round shield with iron boss. On the right lay a long, straight iron sword in a scabbard of hide. Against the right shoulder was laid a long wooden spear and on the left a dagger in a highly ornamented sheath, decorated with gold, as well as a bow and arrows in a quiver. The buckle of a broad belt was generally present and often decorated appliqué for belt and scabbard, fashioned of gold, silver, or bronze. Small gold plates seem to have been sewed to the coat in the shape of a cross. One grave contained a heavy cuirass of plates bound together with iron wire. The horsemen had big shears for clipping manes and a large bronze feed trough with two movable handles; often bits, saddles, and harness were laid beside the dead. The women wore gold hairpins with rounded flat heads, gold earrings of different shapes, finger rings, and gold plates. One ring has the names Gerontius and Regina engraved on it. Crosses and necklaces of gold, and beads of glass, silver bracelets, pottery vases, and plates of glass, cups, combs, and other articles of the toilet accompany the remains of women. Gold coins of the Byzantine emperors cover the reigns [illegible] tasius (491-518) and Mauritius Tiberius (582-602) [illegible] the year 578 Faroald of Spoleto, Duke of the Lombards, conquered Ascoli. The cemetery is therefore attributed to a garrison which he placed at an important pass between the lands on the Adriatic and the country to the west. These graves have escaped the plunderer because no stones were placed above them. Most of the objects have been placed in the Museum of the Thermæ at Rome.

COFFEE AND COFFEE CULTURE.

BY C. B. HAYWARD.

The early history of coffee as an economic product is involved in considerable obscurity, fact and fable being blended to an extent which renders any exact knowledge of it previous to the fifteenth century almost impossible. It is said to have been known as early as 875 A. D., but a pamphlet published by an Arab sheik in 1566 seems to shed the first light upon its origin and early use. It is there stated that coffee was introduced into Arabia from Abyssinia about the opening of the fifteenth century, and that it had been known as a beverage in the latter country from the most remote period. Its peculiar properties were taken advantage of by the Mohammedans in connection with their prolonged religious ceremonies, but its use as a devotional antisoporific stirred up the fiercest opposition on the part of the orthodox element of the priests. Coffee was declared to be an intoxicant, and was accordingly prohibited in the Koran, but in spite of this the coffee-drinking habit spread rapidly. Coffee culture has become as inseparably associated with Arabia as tea with China.

For two centuries the world's supply of coffee was obtained from the province of Yemen in southern Arabia, where the well-known Mocha is still cultivated. Knowledge of the taste and value of coffee spread but slowly, so that it was not until the middle of the sixteenth century that it reached Constantinople. Here it also incited the bitter hostility of the priests. An excessive tax was imposed upon coffee houses, notwithstanding which they flourished and extended. After the lapse of another hundred years, coffee reached Great Britain, where it was introduced by a Mr. Edwards, a British merchant long resident in Turkey. The first coffee house in London was opened in St. Michael's Alley, Cornhill, by his Greek servant, Pasqua Rossie, in 1652, and, remarkable to relate, the introduction of the beverage into England met with the same opposition as in the East. In 1675 Charles the Second attempted to suppress coffee houses by royal edict, in which it was stated they were the resort of disaffected persons, "who spread abroad divers, false, malicious, and scandalous reports, to the defamation of His Majesty's government, and the disturbance of the peace and quiet of the nation." In England, as well as other countries, the most effective check on the consumption of the beverage was found to be a high duty, which led to much smuggling. Coffee is spoken of as being used in France between 1640 and 1660, and thereafter coffee drinking may be said to have become an established habit throughout the civilized world.

Up to 1690 the sole source of supply was Arabia, but in that year it was introduced into Java by the governor-general of the island, and the climate was found to be so well adapted to it, that cultivation was begun on a large scale. One of the first plants grown in Java was sent to the botanical gardens at Amsterdam, and seed from it was sent to Surinam, resulting in its introduction into that country in 1718. Ten years later it found its way to the West India islands, and from that time its cultivation has been general throughout the inhabited portions of the tropics.

The regions best adapted to its culture are well-watered mountain sdopes, varying from one to four thousand feet in altitude and between the parallels of 15 deg. north and 15 deg. south latitude, although it is cultivated from 25 deg. north latitude to 30 deg. south in situations where the temperature does not drop below 55 deg. Fah. According to the altitude at which it is grown, the bean varies in size and color, that from the highlands being small and light green, and nearer the coast of a yellow tinge and much larger; the wild trees of Liberia, which flourish in lowlands, producing the largest beans known, which are, however, inferior in quality, as is the case with the majority of the African product. Eastern coffee generally may be distinguished by its yellow color and large beans, as compared with the smaller green berries of Central and South American growth.

The tree in its wild state is slender, reaching a height of twelve to twenty feet, but under cultivation it is pruned to grow not more than six or eight feet high, for convenience in picking. The leaves resemble those of the laurel, though not so dry and thick, and are evergreen, while the flowers are somewhat like the jasmine. The trees are completely covered with blossoms, which perfume the whole countryside for

days they last. The fruit resembles the cherry much in all stages of development, and especially when ripe, when it is a dark purple. The two semi-elliptic seeds are inclosed in a parchment-like skin, and surrounded by considerable pulp, which is very sweet when ripe. In Costa Rica the coffee-harvesting season is marked by an epidemic of dysentery on the part of the juvenile population, through over-indulgence in this pulp. In cultivating, the plants are grown from seed, and set out when about six months old; they begin to bear at the end of three years, and continue to do so for about twenty years. Considerable space is left between the trees, and plantains, bananas, and other fruits are grown about them, for the double purpose of shade and provision. The first year's crop is small, but when in full bearing, each tree will yield from one to five pounds, according to location and variety.

As few articles of food go through so many and varied processes before appearing in marketable form, it will be of interest to follow the progress of coffee from the blossom to the cup. The trees break forth in a mass of bloom early in the spring, but the complete covering of delicate white blossoms which may be seen in one of the illustrations disappears in a very few days. A period of four to five months has elapsed before the trees have reached the next stage illustrated; and as the bean is firmly attached to the branch, and the region is not subject to heavy storms, the crops are not depleted by windfalls, the tree showing almost as complete a covering of fruit as of blossoms. This may be seen by looking closely at the illustration, which represents the *hacendero* on a tour of inspection, to see if the crop is ready for picking. This latter operation is accomplished by a large force of peasants, each with basket slung over shoulder, in a short time, and the fruit is hauled in lumbering ox-carts of medieval pattern to the patios or drying yards. The latter are literally huge cement floors, which form admirable tennis courts when not being put to their legitimate use, and on a large *finca* (plantation) will cover several acres.

Here the berries are spread out in a layer a few inches deep and then hoed up into rows, being continually turned, so as to present all the fruit to the sun. In one of the engravings the old and new methods are shown side by side, the coffee drying in the sun on the patio and being dried by machine, the latter resembling a huge roaster, and acting in much the same manner. The former cherry-like fruit has now become a tough, black, and wrinkled nondescript, resembling pebbles as much as anything, and with which it is more or less mixed. From here it is shoveled into the large fermenting tanks, where it is covered with water and allowed to remain some time, being continually stirred and having the extremely malodorous water drawn off at intervals. From this process it emerges completely cleansed of the large amount of soft pulp which has hitherto covered it, but the beans are still held face to face by a thin and very strong parchment-like covering, which can only be removed economically by machinery. This is accomplished by a huller, which breaks the beams apart and blows off the covering. The impurities, such as black and worthless beans, stones, etc., are then picked out by hand, and the coffee is bagged ready for shipment. The roasting and grinding are both familiar operations, and are always done where the coffee is to be used, as it loses its aroma quickly in any other but its green state.

MODERN LOCOMOTIVES AT THE ST. LOUIS EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Although the display of modern locomotives in the Transportation Building of the St. Louis Exposition is not marked by that strong international flavor which went so far in lending to the Chicago locomotive display its surpassing interest, it must be admitted that the American locomotive builders have made a most handsome exhibit. Indeed, the number, variety, and thoroughly up-to-date character of the American locomotives render the display of such value and interest that, in spite of the paucity of foreign exhibits, the exhibit is well worth a visit to St. Louis on the part of any railroad man.

We have already, in previous issues of this paper, illustrated several of the leading locomotive exhibits, and in the double-page engraving of the present issue we have grouped a series of the more interesting exhibits that we have not as yet treated. Of the five locomotives manufactured by the Baldwin Company and herewith presented, the three shown in the upper left-hand cut stand at the head of the three long lines which include the greater part of this company's exhibit; while the two other photographs are of a pair of compound express engines which stand on sections of track outside the Transportation Building. The engines at the head of the first and second lines of display are handsome specimens of the very popular Atlantic type of passenger engine, No. 554 having cylinders 20 inches diameter by 28-inch stroke, a heating surface of 2,655 square feet, and a total weight in working order of 183,700 pounds. No. 306 is also a passenger engine of the Atlantic type, but of less weight and power, the cylinders being 19 inches by 28 inches stroke, the heating surface 2,879 square feet, and the weight 169,090 pounds. The huge engine at the head of the third line is the largest and most powerful engine in the world of what might be called the American standard freight type. It has a total weight of 287,240 pounds, and it is only exceeded in weight by the huge articulated locomotive which stands at the head of the Baltimore & Ohio exhibit. The latter engine, however, is of an entirely original type in this country, and stands in a class by itself. The big Baldwin freight engine is of what is known as the Santa Fé tandem compound type, and it is one of several that have been built for hauling trains over the mountain division of the Santa Fé system. The four cylinders are placed in tandem, two on each side, the 19-inch high-pressure cylinders being placed ahead of the 32-inch low-pressure cylinders, and having a common piston rod. The cylinder stroke is 32 inches; the driving wheels are 57 inches in diameter; the total weight of the engine is 287,240 pounds, and the total weight of engine and tender is 450.000 pounds. The total heating surface is 4,796 square feet. The tender has a capacity of 8,500 gallons of water and 10 tons of coal or 3,300 gallons of oil. The total length of the engine over all is 77 feet 10 inches, and as it stands in the Transportation Building it looks every inch of its length and every pound of its great weight. The first engines of this type that were built were placed in service last winter, and since November have made about 30,000 miles each. The heaviest grades are encountered when crossing Raton Mountain, where the ruling ascending grades are very heavy, reaching as high as 158.4 feet to the mile for a distance of between nine and ten miles. The service of these engines has been satisfactory in every respect. Upon test, one of them has taken a train of 2,400 tons up a grade of one per cent for a distance of seven miles at a rate of 18 miles per hour—a feat which the master mechanic of not more than ten or a dozen years ago would have declared impossible.

Two Baldwin compounds, Nos. 507 and 1,587, stand on the outside of the Transportation Building. No. 1,587 is a four-cylinder compound built for the C., B. & Q. Railroad on what is known as the Vauclain system, in which the high pressure cylinders are placed above the low-pressure, the piston rods connecting to a common crosshead. This engine is of a type that has done most successful work in high-speed passenger service. The high-pressure cylinders are 15 inches, the low-pressure 25 inches in diameter, and the common stroke is 26 inches. The other compound, No. 507, is the more interesting machine, because it is of a more novel type, being built on the four-cylinder balanced system. The 15-inch high-pressure cylinders are placed side by side beneath the smoke-box, and are connected to a pair of cranks turned in the leading driving axle. The low-pressure cylinders are on the outside of the frames and connect to the same axle. The adjacent high-pressure and low-pressure cylinders on each side of the engine are placed with their cranks at 180 deg., an arrangement which makes it possible to dispense with the reciprocating counterbalance which is necessary in the ordinary type of engine. The system has shown excellent results, the running being very smooth, and the hammer blow on the rails at high speed being practically eliminated.

Standing adjacent to the Pennsylvania locomotive-testing plant is one of the celebrated De Glehn compound four-cylinder locomotives, which have won such a great reputation for themselves during the past few years on French railways. It is owned by the Pennsylvania Railroad Company, was built specially for them, and forms part of their exhibit. A placard states that it has been purchased with a view to testing the type under the conditions of American railway service, and adopting such elements as may prove to be suitable and useful. This compound is one of the twenty locomotives that are to be tried out on the exhibition testing plant; and after it has been tested it will be placed in regular service on some division of the company's lines. The particulars of the engine are as follows: Two high-pressure cylinders 14 3-16 inches diameter by 25 3-16 inches stroke, and two low-pressure cylinders 23⅝ inches diameter by 25 3-16 inches stroke. The high-pressure cylinders are connected to the rear driving axle, the low-pressure cylinders to the forward driving axle. The valve gear is of a modified Walschaert type. The high-pressure and low-pressure reverse levers are separate; but provision is made for interlocking them when desired. The driving wheels are 80 5-16 inches in diameter, and the total load upon them is 85,000 pounds, the total weight of the engine being 161,700 pounds. The heating surface of the tubes is 2,435.7 square feet and of the firebox 181.8 square feet, and there are 33.9 square feet of grate surface. The steam pressure is 225 pounds to the square inch. This fine engine is credited by the French builders with having developed 1,700 horse-power in service, and it will be interesting to see whether similar results can be obtained under the careful observations of the testing plant.

One of the high-speed locomotives that were used in connection with the official high-speed experiments on the Marienfelde-Zossen line has been shipped to America, and is being exhibited at the World's Fair. This locomotive, built by the Hannover'sche Maschinenbau Gesellschaft vormals Georg Egestorff, Linden vor Hannover, is a four-cylinder compound express engine of the Atlantic type. The engine is fitted with a Von Borries simplified valve gear and a Pielock superheater, giving a heating surface of 310 square feet and superheating the steam to about 300 deg. C. The boiler has 241 solid-drawn iron tubes of nearly 2 inches outside diameter and 14 feet 7 inches length between the tube plates.

There are four cylinders, set in a line across the engine, above the truck. The two high-pressure cylinders are placed between the frames, and the two low-pressure cylinders outside, each pair being cast in one piece with their corresponding steam chests. The two groups of cylinders are bolted together, and carry the smokebox. They rest on the frames, which are of the bar type at the front of the engine, and of the usual plate form behind. The valves of the high-pressure cylinders are piston valves with inside admission, those of the low-pressure cylinders balanced Trick valves. The four pistons are all coupled to the forward driving axle.

In order to lessen, as much as possible, the disturbing influence of the reciprocating parts, the cranks of the high-pressure and low-pressure cylinders upon the same side of the engine are set at an angle of 180 deg. to each other. The cranks of the two sides are at right angles to each other. This arrangement renders it possible considerably to reduce the size of the counterweights, since the reciprocating parts balance each other almost perfectly. As these forces are balanced upon the same axle, they do not strain the frame or other parts of the engine. The arrangement therefore contributes very materially to the ease of the motion of the engine, besides diminishing the wear upon the wheels and the track by hammering. On some trial trips these engines have shown remarkably smooth running at speeds up to 80 miles per hour.

The valve gear is of the Heusinger Walschaert type. The great peculiarity of the valve motion of this engine, however, lies in the fact that both valves on one side of the engine are driven by a single gearing. The two valves are controlled by a single link, which receives its motion from one eccentric, but the stem of each valve is coupled to an advance lever which receives its motion from the crosshead of the corresponding piston.

For the outside valve the link movement is transmitted by a rod with levers of different lengths after the Von Borries patent, so proportioned that the ratio of steam admission is 55 to 30 for low-pressure and high-pressure cylinders in forward and backward gear.

Before being shipped to St. Louis the locomotive was run on the Hanover division of the Prussian State Railway seven days in regular fast train service, and has proved able to haul vestibuled car trains of 300 tons weight with a constant speed of 61 miles per hour on the level and 50 miles per hour on grades up to 1 in 200. The starting is effected smoothly and without any difficulty by a direct admission of live steam into the steam chests of the low-pressure cylinders. This admission is governed automatically by the regulator valve.

So far the Prussian State Railways have twenty-nine of this type of locomotive running or under construction, a lot of nineteen having been ordered this year.

The principal dimensions of the engine are the following: Cylinders, 14 inches and 24 inches diameter by 24 inches stroke. Diameter of driving wheels, 6 feet 6 inches. Steam pressure, 199 pounds. Heating surface, 1,922 square feet. Weight, 132,700 pounds.

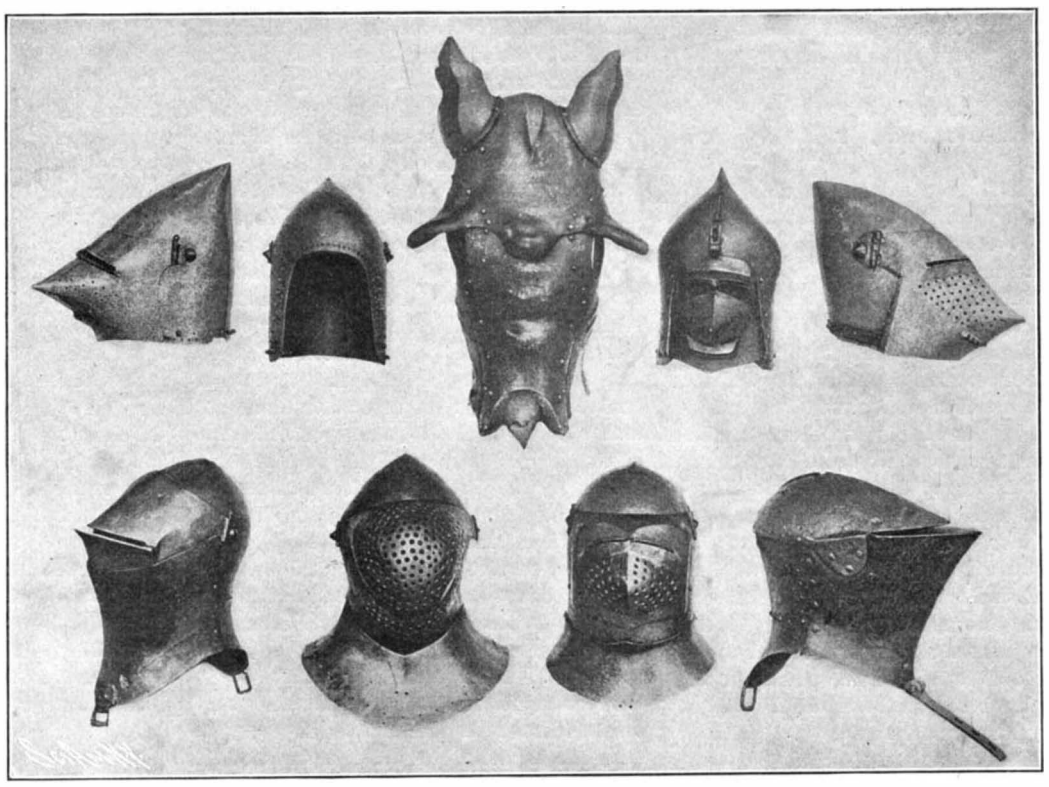
For several reasons the massive articulated locomotive which forms the subject of one of our illustrations is easily the most original among the exhibits of locomotives in the Transportation Building at the St. Louis Exposition. In the first place, it has the characteristic (ever dear to the American heart) of being the biggest thing of its kind in existence. Another distinctive feature is that this locomotive, which was built by the American Locomotive Company, is constructed on the principles of a very successful type of compound locomotive that has been used for many years in Europe for heavy freight service. It is known as the Mallet type, after the inventor. In this system the compounding is divided between two separate engines, each of which is carried on its own separate frame. The high-pressure engine is carried on the main locomotive frame, and the low-pressure engine is carried on a forward six-wheeled radial truck, which

is attached by a vertical hinge to the main frame, a flexible coupling being arranged in the steam pipe, leading from the high-pressure to the low-pressure cylinders. The high-pressure cylinders are 20 inches diameter by 32 inches stroke, and the low-pressure cylinders 32 inches diameter by 32 inches stroke. The enormous boiler has a diameter of 84 inches. It carries 5,366.3 square feet of heating surface in its tubes, and 219.4 square feet of heating surface in its firebox, making a total of 5,585½ square feet for the whole boiler. The firebox has a total length of 108⅛ inches, a width of 96¼ inches, and the grate area is 72.2 square feet. The total weight on the driving wheels, which are 56 inches in diameter, is 334,500 pounds, this being the total weight of the engine. An interesting fact is that the 436 tubes in the boiler have a total length of not far short of two miles. With a boiler pressure of 235 pounds to the square inch, and using live steam in all four cylinders (which the enormous boiler capacity renders possible, not merely at starting, but steadily when the engine is under way) this remarkable locomotive can exert a drawbar pull of 82,000 pounds, and a drawbar pull of about 71,500 pounds when she is working compound.

Now as to actual results attained. Previous to sending the engine to St. Louis, the engine was tested under the conditions of actual service at Schenectady, when she took a 63-car train weighing 3,150 tons up a one per cent grade. As to what she could do on the level, it can safely be said that she would be capable of hauling a train of considerably over twice that weight at a speed of from ten to twelve miles per hour.

Three different companies at the Fair exhibited complete passenger trains, the cars representing the very latest development of the car-builders' art. The Pullman Company had a train of cars in which every modern improvement and the latest ideas on interior finish and furnishing were exemplified. The N. Y. C. & H. R. Railroad Company exhibited a complete Empire State Express train, which was recently illustrated in this journal, the train being complete, even to the new balanced compound locomotive at its head. We present in our two-page group of illustrations a photograph of another complete train exhibit, made by the Missouri Pacific Railroad Company. This train was made up of six cars as follows: First a United States railway postal car, 63 feet 6 inches long over buffers, and 10 feet wide, the framing of which is made in accordance with railway mail service specifications; then a standard baggage and express car, 63 feet 4 inches long over buffers and 10 feet wide over side sills; then two vestibule coaches, 69 feet 8¼ inches long by 10 feet wide; a chair car of same length and width; and a dining car 79 feet 4¼ inches by 10 feet in width. A special feature of this car is a private dining room, with an oval table large enough to seat six people. The whole train, which was built by the American Car and Foundry Company, is of interest as exhibiting the modern tendency to abolish extremely heavy and over-rich interior decoration and resort to a lighter and simpler style. Also, there is a noticeable tendency to increase the size of the windows, even those of the ordinary day coaches being of exceptional width, providing a long stretch of unobstructed outlook. The engine at the head of the train is a six-connected, simple engine, with cylinders 20 by 26 inches; 69-inch driving wheels; and a heating surface of 2,930 square feet. The working pressure is 200 pounds to the square inch, and the total weight of engine 183,200 pounds.

The Helmet and Shield of Louis XIV.



A Collection of Casques and Head Pieces; the Second Helmet from the Left in the Top Row is Supposed to Have Been That Worn by Joan of Arc.

After prolonged delay the Italian government has at last introduced the measure sanctioning construction of the Apulian aqueduct. This project consists of an irrigation system for the arid tableland of Apulia. The aqueduct is to cross the Apennines by means of a tunnel 7½ miles long, and will have several subsidiary canals, so that twenty-one communes of the province of Foggia, and all those of the provinces of Bari and Leece, will receive an adequate supply of water. These communes contain a population of nearly two millions. It is estimated that the scheme will cost $25,000,000, and will not be completed before the year 1920.

THE DINO COLLECTION OF HISTORIC ARMOR.

BY ISABEL R. WALLACH.

The collection of armor gathered by the late Duc de Dino, Marquis of Talleyrand-Perigord, and now the property of the Metropolitan Museum of Art in New York, is a revelation of the degree of beauty to which metal work may be carried, and also of the wonderful effects achieved by the medieval armorers. Truth of line, integrity of purpose, and strength of construction distinguish each piece, and bear testimony to the fidelity and skill of the craftsman. Inlay and overlay, chasing and pierced work, damascene and etching,

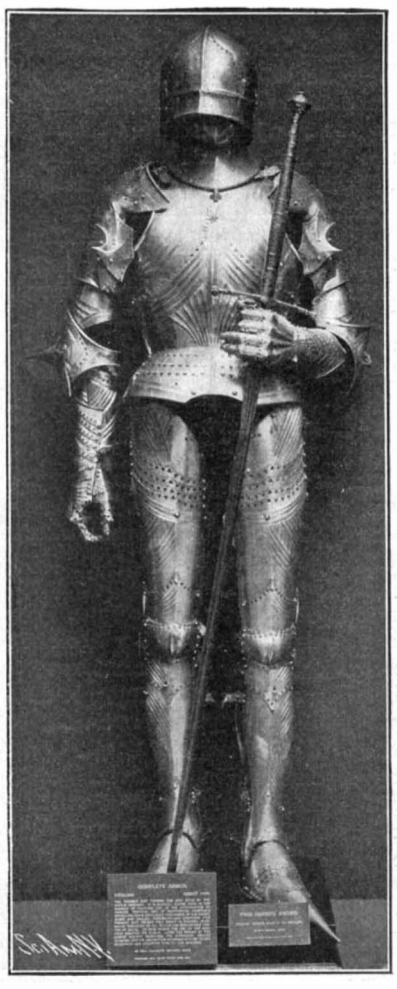
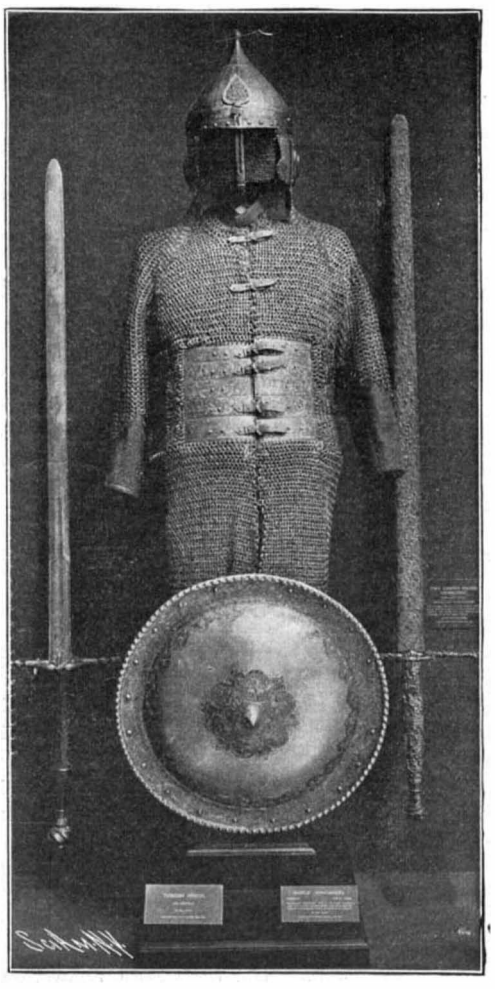
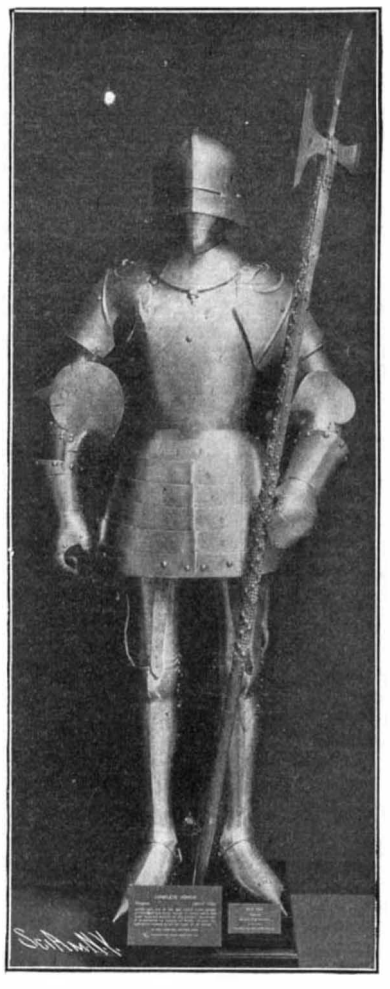


Plate Armor of Florid Workmanship (1490). Typifies the Best Work of the Gothic Armorer in the Anatomical Modeling of Steel.

Striped Armor, Black and Silver Etched, of German Workmanship. The Shoe and Gauntlet are Made of Separate Plates to Secure Flexibility and Suppleness.



A Turkish (Saracen) Coat of Chain Mail (XVI. Century). The Shield is of Contemporaneous German Workmanship, and Probably Designed for a Spanish Knight.



One of the four extant Gothic suits dating from 1450, considered the most valuable in the Dino Collection. This suit bears the marks of the armorer's proof-tests.

THE DINO COLLECTION OF HISTORIC ARMOR.

enamel, embossing, and repoussé, crowd every available inch of surface, yet never to the detriment of the grim business of defense.

One of our illustrations is a side view of the plate armor neck piece and chamfron that protected the war horse of Henri II. A front view of the same specimen is presented in the illustration showing a collection of head pieces. The equine neck and head piece illustrated is remarkable for the accurate modeling displayed.

The collection is particularly rich in elaborately etched and gilded head pieces. The helmet-roofs served for reinforcing guards when the marvelous temper of a swiftly-descending blade cleft the very iron, or the force of the crashing battle ax tore its way through the stoutest steel. Many of these pieces bear the emblems of royalty; others were the property of mighty rulers, among them the Medici and the Saxon electorate princes.

The armor in the collection is particularly striking, the various specimens showing clearly the influence of the different periods. One of the accompanying illustrations is a complete suit of armor of Italian make to which the date 1450 may be assigned. This austere garment of steel shows the stamp of tests which have proved its protecting qualities. The suit is one of the few (about four) extant dating from the fifteenth century. It ranks among the most valuable objects of the entire collection. Mounted on the same stand with this suit is an Italian war-ax, likewise dating from the middle of the fifteenth century.

The pierced trefoils and the curved lines in the Gothic suit bearing the date 1490, also pictured in one of the accompanying illustrations, show the influence of the Italian school. The corrugations add strength, a very important factor in a suit that weighs but forty pounds. At the time when this suit was fashioned, the armorer's skill was at its highest. The specimen shows anatomic modeling of unusual quality. Particularly is this noticeable in the armor of the hands, knees, and ankles. The flexibility, the graduated thickness of all the plates, and the remarkable temper are qualities that have aroused the admiration of those who may be considered authorities on medieval steel working. After this period, the weight of the armor rapidly increased; its flexibility became impaired, and its decoration belonged rather to the goldsmith's and sculptor's than to the armorer's art. The mailed fist of the figure shown clutches a two-handed sword, Spanish in its origin and wrought some time during the second half of the fifteenth century.

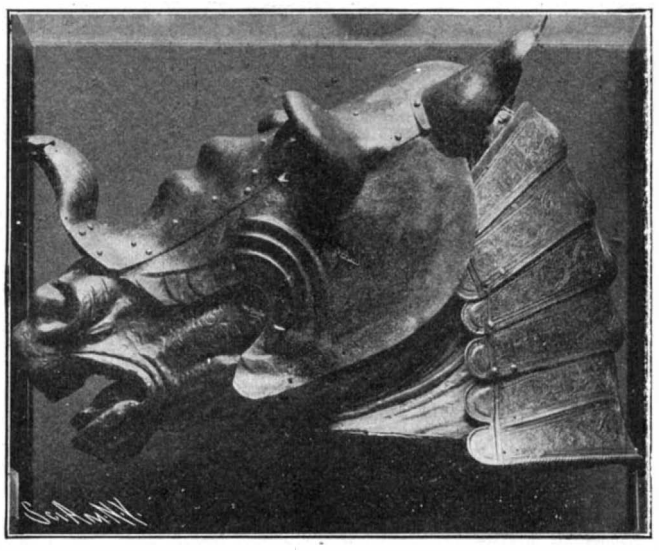
The handsome armor of alternate stripes of black and of silver damascene, also included in our illustrations, is of later date. It is of German manufacture. The shoe and gauntlet are built up of separate plates, conferring the suppleness and flexibility which the swordsmanship of that day required.

Splendid with gold repoussé is the half armor designed for the great Gonsalvo de Cordoba, presumably about the year 1590. Its gorget is ornamented with the collar of the Golden Fleece. The temper of the metal is unsurpassed. This example resembles closely that of Alessandro Farnese, Duke of Parma, preserved in the Vienna Museum. Immediately below the armor, a Milanese shield (*rondache*) likewise dating from the second half of the sixteenth century, is mounted. It represents a fierce struggle of mail-clad knights wonderfully executed.

A fitting companion piece of the same period, no less elaborate in finish and even more artistic, is the beautifully etched and gilded half armor signed by Pompeo della Cesa. The scalloped edges that peep from under the skirt and shoulder pieces belong to the velvet garment worn underneath. The shield (*rondache*) displayed beneath the armor was made somewhere about the close of the sixteenth century by an Italian craftsman.

The specimen of sixteenth century chain mail illustrated herewith and the helmet above it are Turkish. The shield below is of contemporaneous German workmanship. Both show elaborate gilding and etching. Their juxtaposition gives the student a fine opportunity for comparing the German and Saracen schools. The shield was probably designed for a Spanish nobleman—at least that is what competent authorities surmise. To the left of the armor, a German (Saxon) two-handed sword is hung, which was also made about the sixteenth century. Contrasting strongly with the deadly earnestness of this weapon is the two-handed ceremonial sword displayed to the right of the armor. Like the former, this is of German workmanship, probably the product of some Swiss craftsman. It is of earlier date, and was fashioned probably in the second half of the fifteenth century. The handle carved in the purest Gothic style was originally in another collection. The blade, hilt, and sheath, however, date from the same period.

The exhibit of helmets in the collection is most comprehensive. From the simple iron hat, ludicrously suggestive of an inverted kettle, to the shapely and truly royal burginet of Henri II. of France, is a far cry. Between them are a dozen different varieties, each planned to protect its wearer from the crushing weapon of a foe. Some are purely classic in shape, and show much decoration; others, like that of the Maid of Orleans, are simple to severity and almost bare of ornament. The gorgeous helmet of Henri II., its sides telling in rich relief of the victory of Hercules over the Centaurs, is part of the gilded armor he wore when, as Dauphin, he visited his royal father, Emperor Charles V., confined a prisoner of war in Madrid. Near it is the chamfron previously mentioned, that protected his horse's head, marked with his initial and the date 1539; it is one of the few of the collection that permitted the animal to use his eyes. The majority of the chamfrons utterly prevented the charger from seeing, in order to prevent his shying at the critical moment. There are helmets in the collection that were worn by the body guards of Pope Julius III., of Cosmo di Medici, of the Great Elector, and near them Saracen and Turkish casques with their distinctive domes and peculiar visors. These casques are elaborately chased and gilded, but in deference to the strict Moslem commandment, there is no trace in the pattern of a graven image—only a beautiful labyrinth of arabesque and geometric lines.

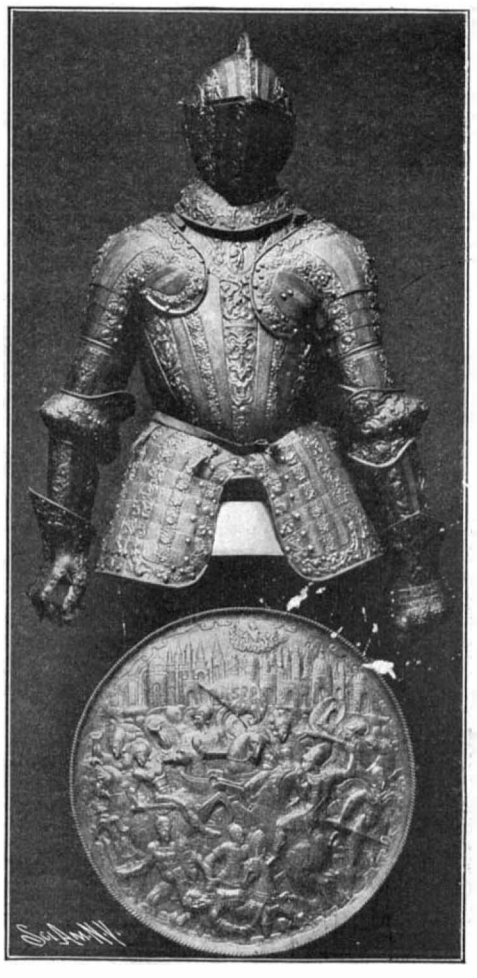


The Chamfron (Horse's Head Piece) Worn by the Charger of Henri II.

Pendants and medallions that decorated the bits and bridles of the horses are displayed by the score. There are also parts of the plate armor that protected the chargers from the lances of enemies.

An important member of the Dino collection is the shield and helmet of Louis XIV. Just how these and other royal caparisons were permitted to leave their native soil is a question that must embarrass French collectors. The Louis XIV. pieces are classic, and their decoration of gilt and bronze of an unusually high order of artistic merit. During Louis XIV.'s reign it was that the use of armor was officially abolished; for that reason his royal shield and helmet fittingly close a collection of inestimable value to the student of history and of art, and to the layman who finds the living present the logical development of a no less living past.

Milanese Half Armor by Pompeo della Cesa (1590).



Milanese Half Armor Made by Lucio Piccini for Gonsalvo de Cordoba (1590).

THE DINO COLLECTION OF HISTORIC ARMOR.

Preventing Hydrophobia by Vaccination.

Pasteur's vaccination method for the prevention of hydrophobia in people bitten by mad dogs is employed at the institute for infectious diseases at Berlin. The "Cultus" ministry has just published a statement with reference to the cases of persons bitten by mad dogs which have come to the knowledge of the authorities during 1903, and which permit a judgment on the merits of such vaccination based upon authentic facts.

In the year 1903, 307 persons were bitten by 194 mad dogs or dogs suspected of madness; in 140 of these dogs hydrophobia was afterward proved beyond a doubt, while 13 were found to be healthy; the rest could not be examined. The 307 persons lived in eight different provinces—226 of them in eastern Prussia, western East Prussia, and Silesia, which are close to Russia. Thus Russia is again shown to be the breeding place of this plague. Of those bitten, 281 proceeded to the institute for infectious diseases and were vaccinated. Four of them died of hydrophobia and one recovered after a slight attack. Deaths took place on the thirty-eighth, fifty-sixth, one hundred and tenth, and one hundred and thirty-fifth day, respectively, after the bite.

Vaccination has not proved an absolutely certain remedy, even when applied right after the bite. The statistics show, however, that of 281 persons vaccinated only 4 died, that is, 1½ per cent; while of those not vaccinated but treated medically 6 per cent died, and of those neither vaccinated nor treated 11 per cent died.

"In view of these figures," the statement proceeds, "it is earnestly to be recommended that all persons having the misfortune to be bitten by dogs either mad or suspected of madness at once submit to vaccination. The value of such vaccination is being more and more recognized. During the last six years the percentages of persons bitten who submitted to vaccination were 29, 80, 82, 78, 90, and 92 respectively, and it is to be hoped that in the future every bitten person will avail one's self of it."

Automatic Packing Machine.

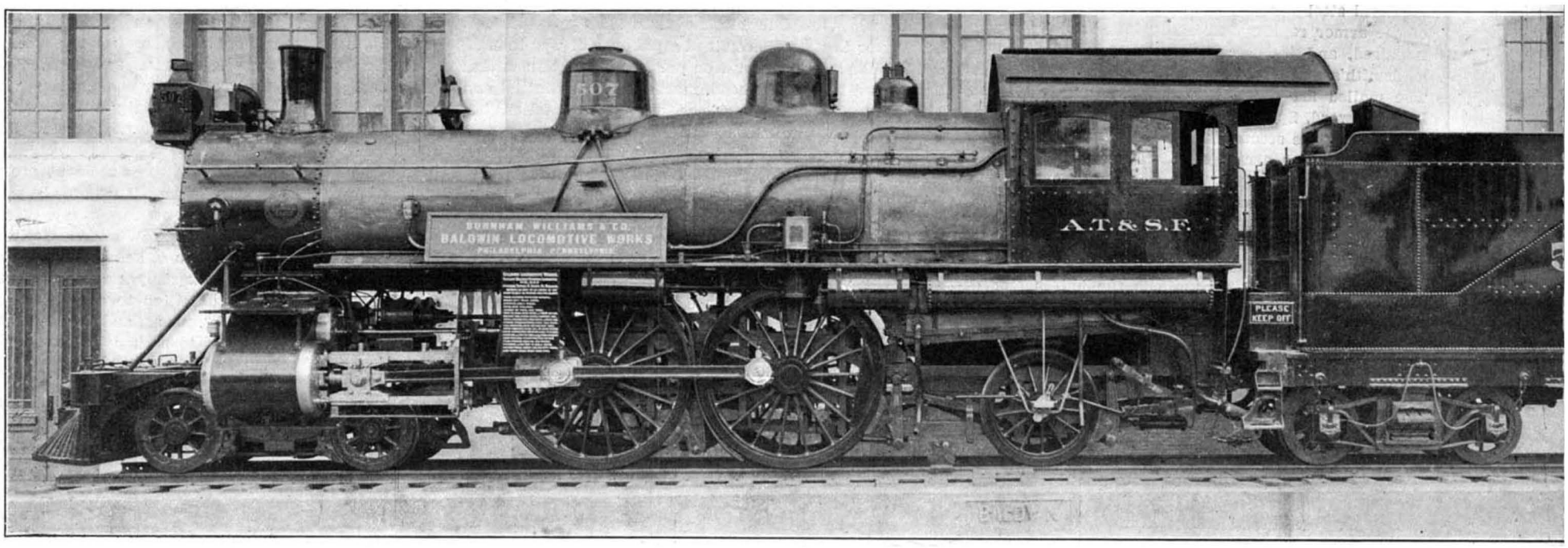
An ingenious packing appliance has been invented by Mr. Van Allen, of Paris. By means of this apparatus, which is almost human in its action, it is possible to fashion the package, charge it, and then seal it ready for transit. The appliance is a combination of a weighing machine and a packer. First the machine cuts off the requisite length of lead, paper, or whatever is utilized for the envelope, from a continuous traveling band, pastes and folds it into shape, leaving the mouth of the bag open. The package then passes along, stopping in its passage for a moment to receive its contents of tea, sugar, or cereals, through a funnel. It makes another forward movement, and an elastic pressure piston comes into action and rams down the contents to the minimum volume. By a further series of operations the bag is shaken into shape, pressed, and the ends are folded down, pasted, and then labeled. Not once during the operation is the bag or its contents touched by hands. The inventor has been engaged for three years upon his device. When perfected it will perform the work of seventy people and complete the whole cycle of operations at the speed of forty packages per minute, thus effecting a remarkable saving in time and expense.

Cylinders, 20 x 28 inches. Heating surface, 2,655 square feet. Weight, 183,700 pounds.
Atlantic Type Passenger Engine.

Cylinders, 19 x 28 inches. Heating surface, 2,879 square feet. Weight, 169,090 pounds.
Atlantic Type Passenger Engine.

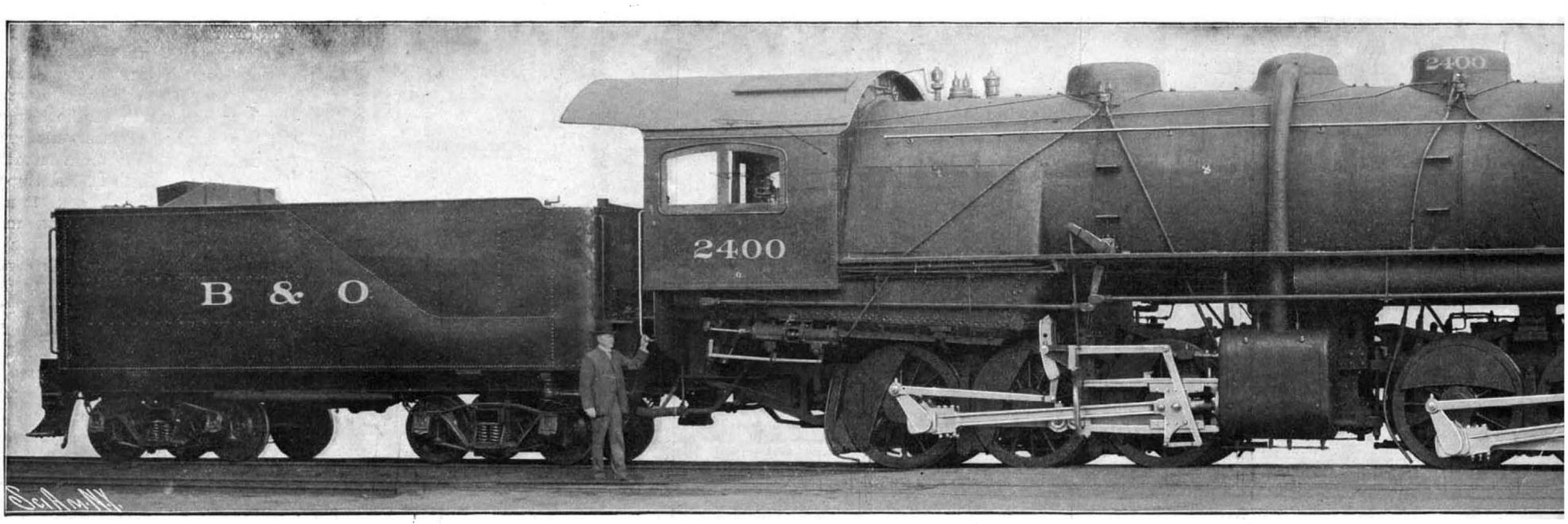
Cylinders, 19 x 32 x 32 inches. Heating surface, 4,796 square feet. Weight, 287,240 pounds.
Compound Tandem Freight Engine.

Front View of Three Lines of Modern Locomotives.



Cylinders: high-pressure, 15 inches; low-pressure, 25 inches diameter. Stroke, 26 inches. Diameter driving wheels, 79 inches. Heating surface, 3,206 square feet. Pressure, 220 pounds. Weight, 19

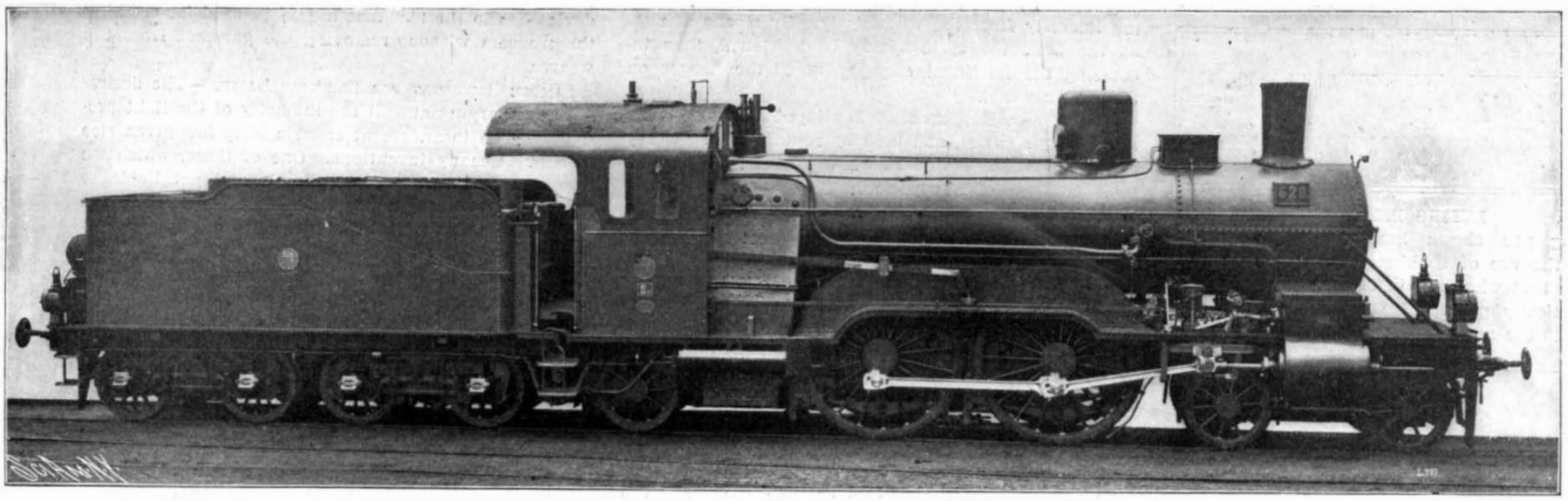
Four-cylinder Balanced Compound, for the Atchison, Topeka & Santa Fé Railway System.



Cylinders, 20 and 32 inches diameter by 32-inch stroke. Diameter of boiler, 7 feet. Heating surface, 5,586 square feet. Working pressure, 235 pounds. Weight of engine, all available for adhesion, 334,500 pounds. Maximum tract

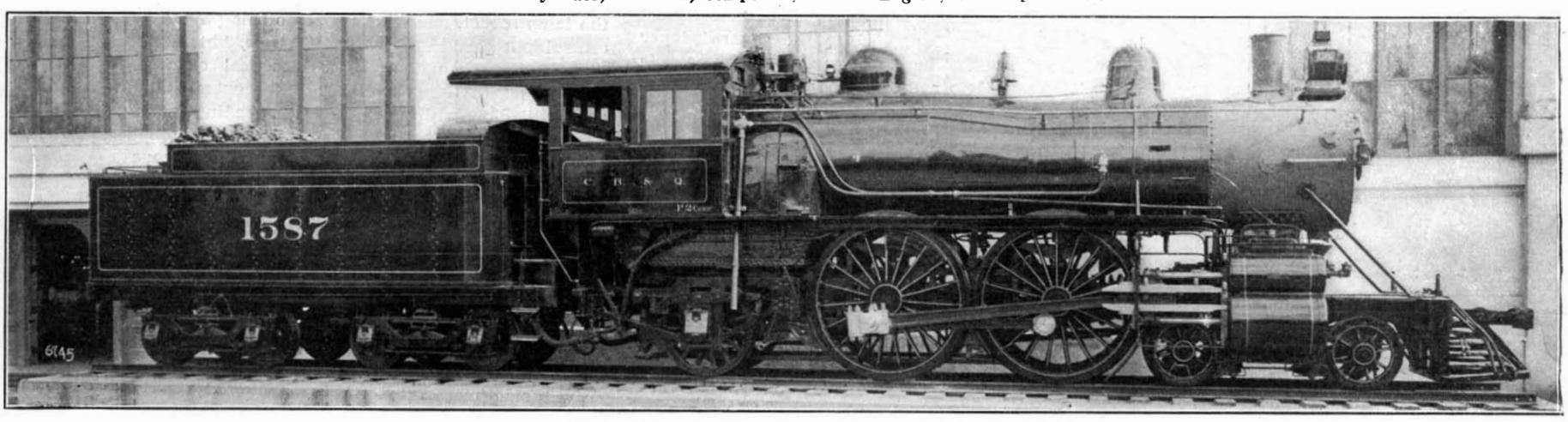
B. & O. Freight Locomotive, the Heaviest and Most Powerful Locomotive Ever Built.

THE LOCOMOTIVE EXHIBIT AT



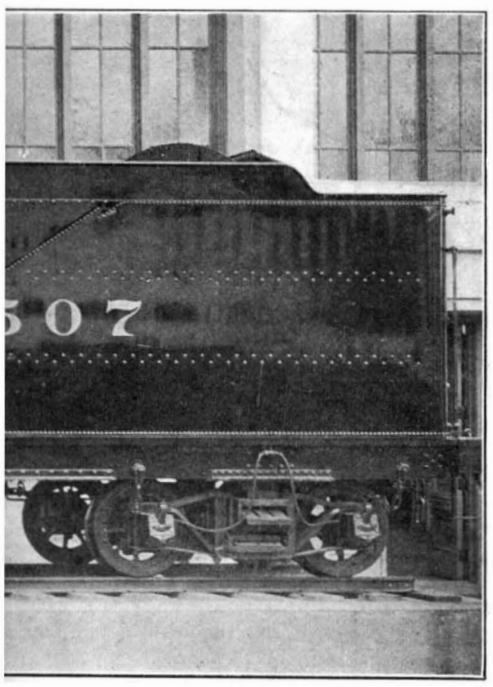
Cylinders, 14 and 24 inches by 24 inch stroke. Diameter driving wheels, 6 feet 6 inches. Heating surface, 1,922 square feet. Weight, 132,700 pounds.

Four-cylinder, Balanced, Compound German Engine, with Superheater.

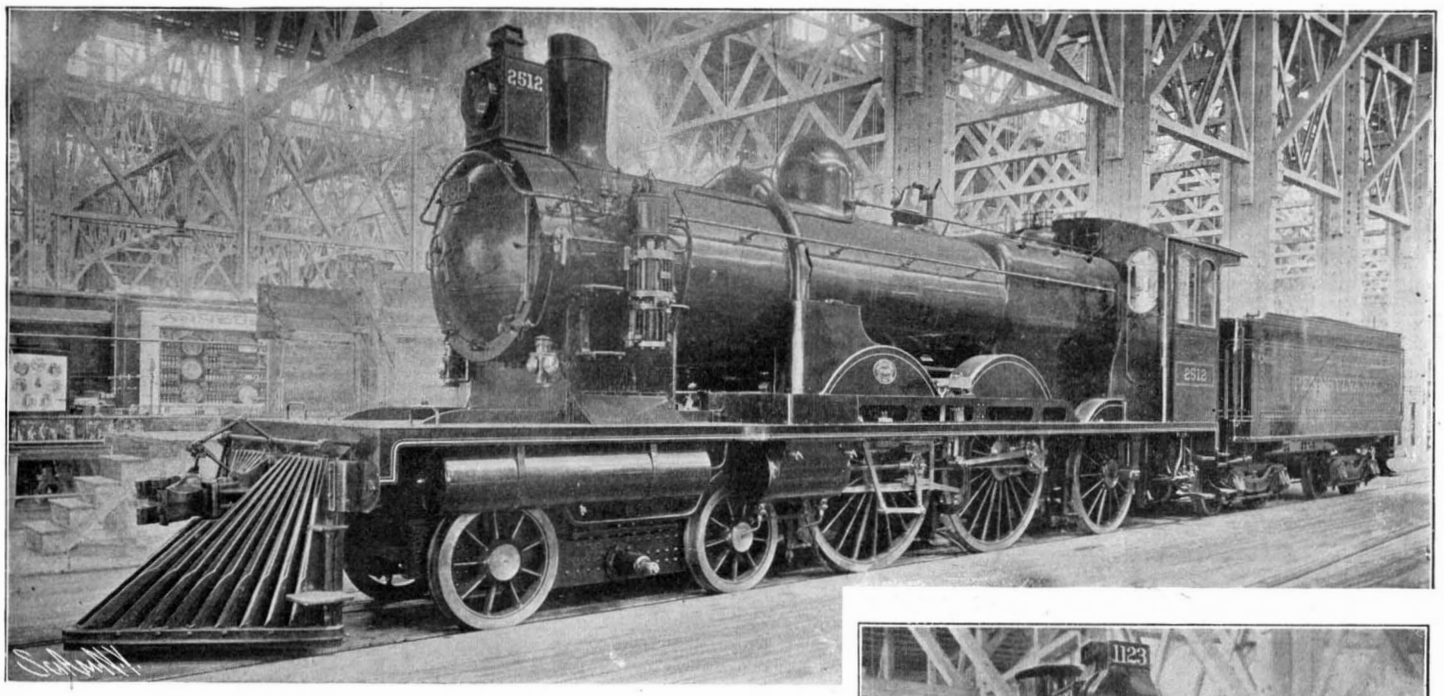


Cylinders: high-pressure, 15 inches; low-pressure, 25 inches. Stroke, 26 inches. Diameter driving wheels, 84¼ inches. Heating surface, 3002.5 square feet. Steam pressure, 210 pounds. Weight of engine, 183,080 pounds.

Four-cylinder Compound for the C., B. & Q. Railroad.

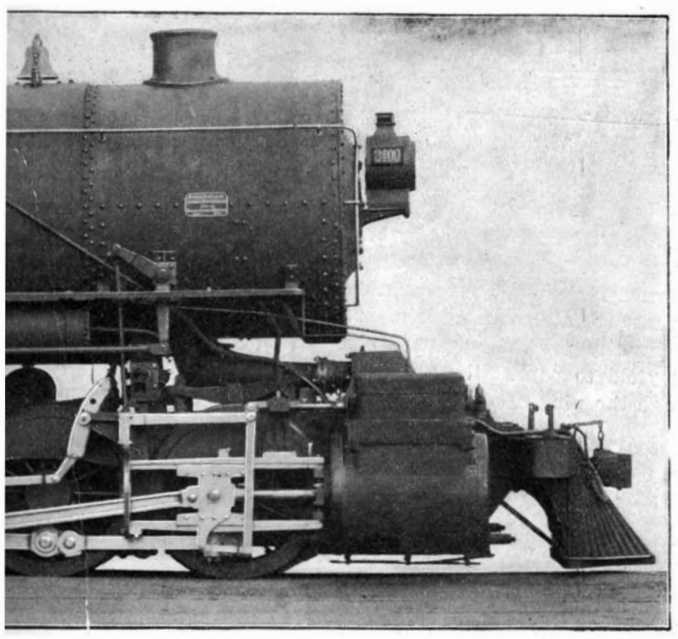


3,760 pounds.

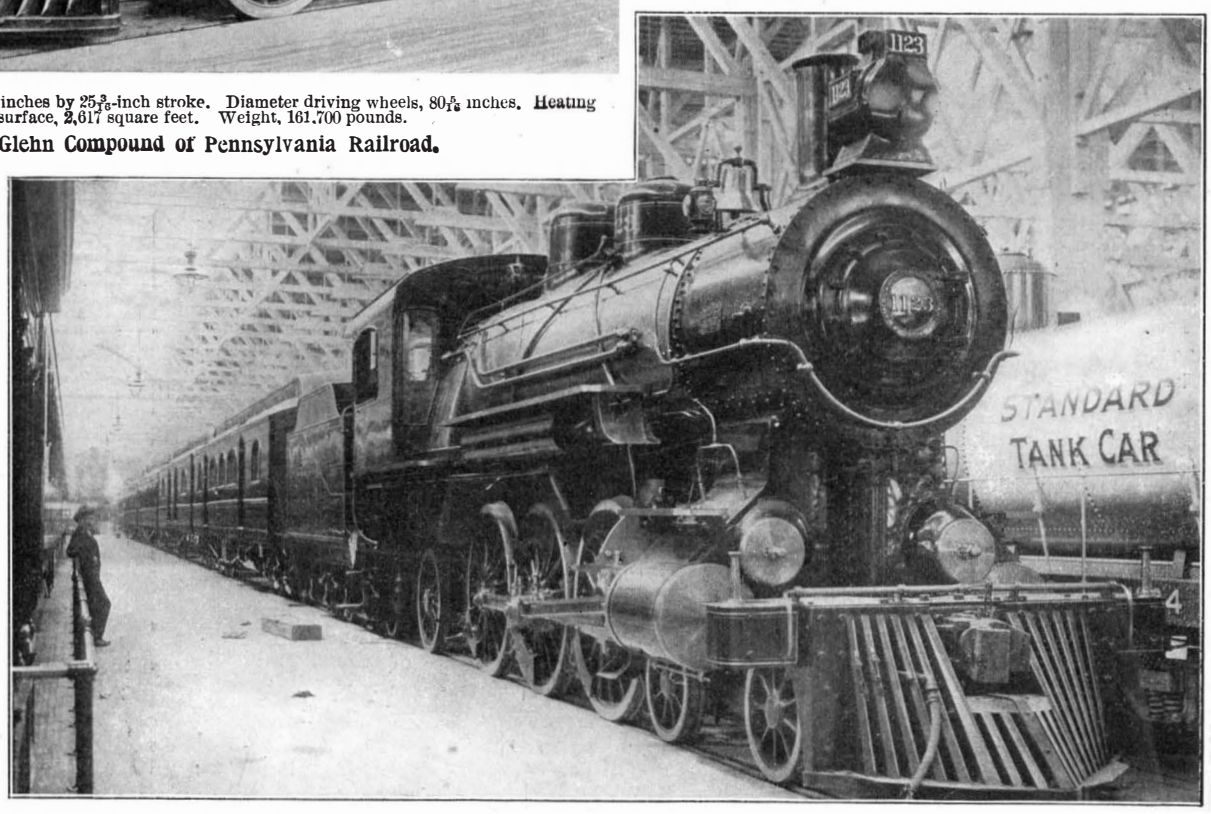


Cylinders, 14 3/16 and 25 5/16 inches by 25 3/8-inch stroke. Diameter driving wheels, 80 7/16 inches. Heating surface, 2,617 square feet. Weight, 161,700 pounds.

De Glehn Compound of Pennsylvania Railroad.



ive power, compound, 71,500 pounds; working simple, 82,000 pounds.



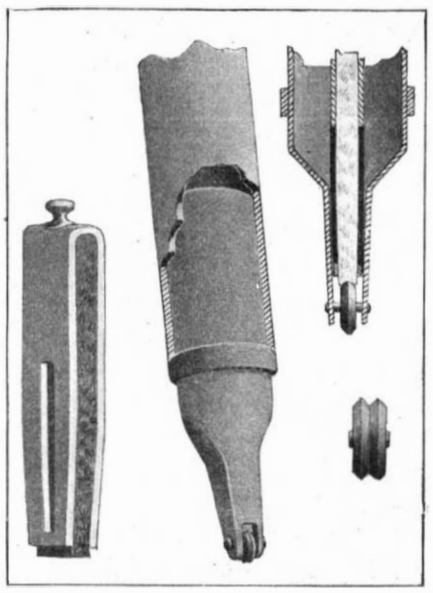
Cylinders, 20 x 26 inches. Driving wheels, 69 inches diameter. Heating surface, 2,930 square feet. Working pressure, 200 pounds, Weight of engine, 183,200 pounds.

Complete Missouri Pacific Engine and Train.

Patent Department

RULING PEN.

The ruling pen shown herewith is particularly adapted for the use of bookkeepers, and its arrangement is such that when not in use, the ink it carries will be practically prevented from drying out. The pen belongs to the marking-wheel type, and comprises



RULING PEN.

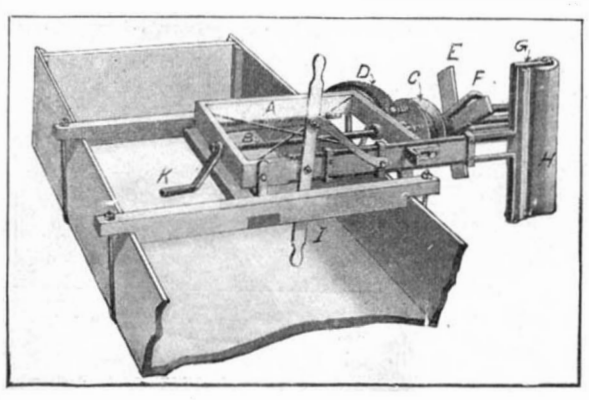
a pair of wheel holders, removably or reversibly fitted in each end of a tubular handle. The wheel holders each comprise a hollow body portion, with a flat extension in which the marking wheel is journaled. The opposite end of the hollow body portion is closed by a cap. Fitted within the holder is a metal plate bent to U-shape, within which an inking-pad is held. The pad presses against the upper edge of the marking wheel, and thus supplies it with ink. The pad holder is formed with a slot in its wall, through which a pin may be inserted to adjust the pad when necessary. Preferably one of the wheel holders is provided with a double wheel, and the other with a single one, so that the same instrument may be used for making a double or single line as desired. Normally, the holders fit snugly in the tubular handle with the wheels projecting inward, so as to prevent injury to the wheels or evaporation of the ink. A collar formed on each wheel holder prevents it from slipping too far into the handle. When using the pen, the desired wheel holder is taken out and slipped back into the handle, with the marking wheel projecting outward. By pressing the flat extension of the wheel holder against a ruler, the marking-wheel may be guided evenly, to make a clear, straight line. Mr. Eugene A. Bagby, of Winchester, Ky., is the inventor of this instrument.

WIRE-REELING APPARATUS.

The apparatus herewith illustrated is adapted for reeling up a fence wire which is being removed from the posts or for paying out a wire when erecting a wire fence. It is arranged to be carried on a wagon, and may be readily swung from one side of the vehicle to the other, as occasion may require.

The apparatus comprises two rails laid across the wagon, and held in place by bolts. These rails are connected by a cross brace to which a metal bar is secured. A square frame *A*, which carries the reel shaft *B*, is journaled in the upturned ends of this bar. A friction wheel *C* is slidably carried on the shaft *B* in such position as to engage the wheel *D* of the wagon.

The friction wheel is formed with two inclined flanges, which embrace the rim of the wagon wheel, one of the flanges being loosely mounted on the hub of the friction wheel, against which it is pressed by a number of coil springs carried on stud-bolts projecting laterally from the wheel body. By means of nuts on the bolts the springs may be tightened, thus increasing the frictional engagement of the flanges on the wagon wheel.



WIRE-REELING APPARATUS.

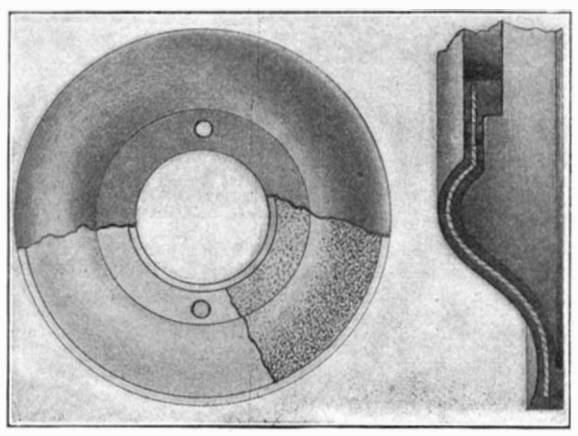
The wire-holding spool *E* is slipped onto the outer end of the shaft *B*, and held by means of a split key against a clutch device *F*, which interlocks with the head portions of a wire-holding spool, causing it to rotate when the wagon is drawn forward. The slidable connection of the friction wheel *C*, with the shaft *B*, adapts it to yield laterally, so as to compensate for any wobbling of the wagon wheel.

When reeling up the wire, it is guided between a guide bar *G* and a vertical guide roller *H*. These are carried between the ends of a pair of straps, which are slidably secured to the forward member of the reel frame *A*. By means of the operating lever *I*, the roller and guide bar may be moved back and forth to lay the wire evenly on the spool. When the end of the line of fence is reached, the frame *A* is swung over on its pivots to the other side of the vehicle, and the wagon is turned around for the return trip. When approaching a corner of the fence, or some place which is inaccessible to the wagon, the spool may be turned by a crank handle *K* applied to the squared inner end of the shaft *B*. The bar in which the frame *B* is pivoted is secured to a cross piece by a central pivot bolt and a removable bolt. When paying out wire the latter bolt is removed, and the bar is held instead by a wooden pin. In case the tension on the wire becomes too great, this pin will break instead of the wire. A patent for this wire-reeling apparatus has been granted to Mr. Benedict Reichenberger, of Huron, Kansas, Rural Route No. 1.

PUMP DIAPHRAGM.

A new type of pump diaphragm has just been invented by Mr. Edwin George, Jr., of 28 South Street, New York city.

This diaphragm is made of an upper and lower



PUMP DIAPHRAGM.

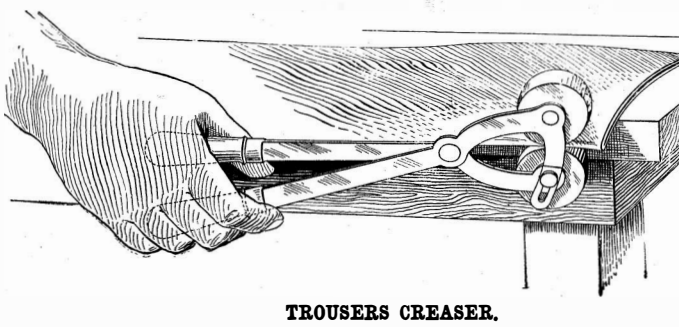
layer of rubber, between which is an interlining of waterproof leather, the whole being firmly cemented together.

Diaphragms have heretofore been made with a cotton duck interlining, but considerable difficulty has been experienced in making such a diaphragm sufficiently strong to do certain kinds of work, such as pumping out trenches filled with water containing sand, gravel, or sewerage. The canvas is also apt to deteriorate under conditions of usage, thereby rendering the diaphragm practically useless in a comparatively short space of time.

All these difficulties are obviously overcome by the use of a rawhide interlining. The leather is practically as pliable as the cotton duck, so that the resiliency of the diaphragm is not destroyed. Furthermore, its tensile strength is much greater than the best cotton duck, and being unaffected by water, it makes the diaphragm more serviceable, and adds greatly to its life.

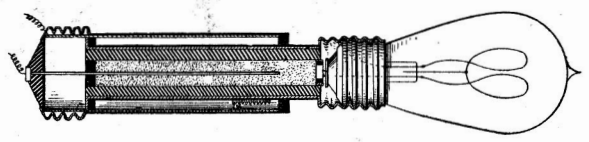
ODDITIES IN INVENTION.

TROUSERS CREASER.—An Illinois inventor has recently devised a novel form of iron for creasing trousers. It consists of a pair of rollers mounted upon a pair of handles, which are hinged together in the manner of a pair of tongs. The device may be heated by a gas jet or otherwise, and the garment is then creased by being passed between the rollers. The inner ends of the rollers are slightly beveled so that no noticeable line will be formed between the pressed and unpressed portions of the trousers. One of the handles is formed with an arm which extends from one of the rollers to the other, and is provided with a slot adapted to engage the pivot stud of the latter roller, thus limiting its movement. The arm also serves as a guide to limit the extent to which the cloth may be inserted between the rollers. The principal advantage of this device lies in the fact that it may be used for creasing the trousers without removing the garment from the wearer.



TROUSERS CREASER.

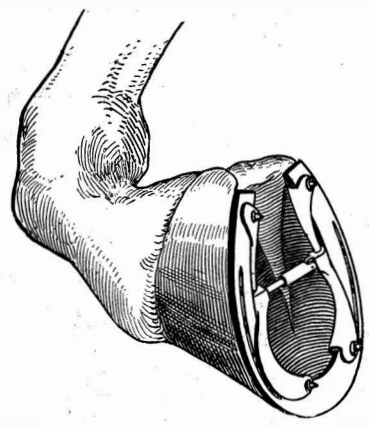
SIMPLE RHEOSTAT FOR ELECTRIC LAMPS.—The desirability of varying at will the intensity of the light produced by an incandescent electric lamp has given rise to a great many inventions. One of these, which we illustrate herewith, is very simple and not liable to get out of order. It consists of a rheostat formed of two telescoping tubes. The inner tube, which is formed of insulating material, carries the lamp socket. The sleeve of the lamp socket extends to the top of the inner tube, where it is bent out to make contact with the inner wall of the outer tube. The inner tube is filled with a quantity of resistance material such as graphite, which rests on the central contact piece of



SIMPLE RHEOSTAT FOR ELECTRIC LIGHTS.

the lamp socket, and extending into this graphite is a central pin carried by the outer tube, but insulated therefrom. When the proper electrical connections are made with this pin and with the outer tube, the lamp will glow with a brightness depending upon the amount of graphite interposed between the pin and the central contact in the lamp socket. By means of a pinion journaled in the outer tube, which engages a rack on the lamp socket sleeve, the inner tube may be drawn in or out to any desired extent, thus regulating the intensity of the light to a nicety.

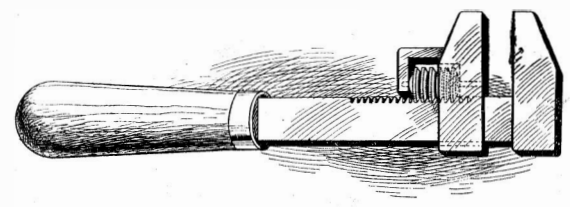
HORSESHOE ICE CREEPER.—Illustrated herewith is an inexpensive device which can be detachably connected to a horseshoe to prevent the horse from slipping upon the ice. The device is so arranged that it can be adjusted to horseshoes of different sizes. It comprises curved side members formed with grooves so that they can be fitted on to the inner edges of the horse-



HORSESHOE ICE CREEPER.

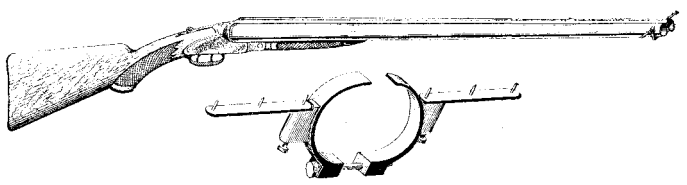
shoe. These members carry calks at each end for engaging the ice. The side members are held in position by a turnbuckle which is operated to spread them apart. Each side member is formed of two sections, one of which is threaded into the other, so that they can be adjusted to any desired size or form of horseshoe.

QUICK-ACTING WRENCH.—The wrench shown herewith is arranged to permit a rapid adjustment to any desired position. The worm which operates on the rack to raise or lower the movable jaw is cut away at one side, so that it can be turned to clear the rack. The jaw can then be adjusted up to any desired position, and its hold tightened by bringing the worm again into engagement with the rack. To hold the worm, it is turned far enough to bring a depression in its upper face into register with a spring-pressed pin. The worm is normally pressed upward by a disk spring, which will yield to permit the worm to turn far enough to engage the pin.



QUICK-ACTING WRENCH.

GUN SIGHT.—It is estimated that at a distance of thirty feet a huntsman should aim his gun two feet in advance of a flying mallard duck, and four feet in advance of a teal duck, in order to properly cover the bird. To assist the hunter in thus aiming his gun, an Iowa inventor has devised the gun sight here illustrated, which may be quickly applied to any shotgun. It consists of a pair of curved members, which may



GUN SIGHT.

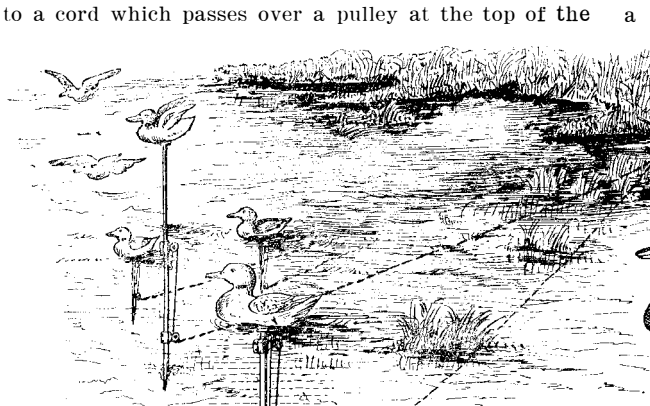
be clamped to the barrel of the gun by means of a clamping screw. These members each carry an arm provided with a number of sights, spaced at suitable intervals thereon. The hunter can determine, at a glance, which one of these sights it is desirable to use, and by keeping the proper sight directly on the game, will be able to fire with great accuracy.

SUNSHADE.—A sunshade has recently been invented, which can be carried by a person without interfering with the free use of his arms. As shown in the engraving, the sunshade is attached to a wire yoke-piece adapted to be fitted over the wearer's shoulders and strapped in place. Aside from its pivotal connection with the two upwardly-projecting arms of the yoke-piece, the sunshade is also provided with guy

SUNSHADE.

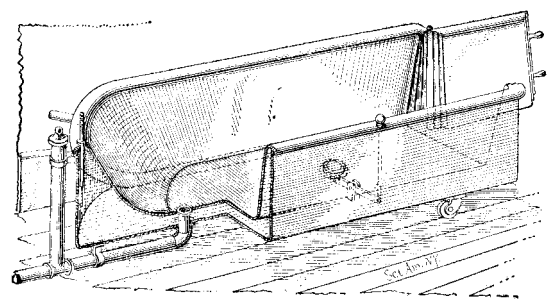
cords which extend through eyes on the yoke-piece. By this arrangement the shade may be tilted to any desired position, and held by inserting plugs in these eyes. This invention will be found useful to travelers in tropical countries, as it will provide a good protection from the sun's hot rays or from rains without in the least encumbering the wearer.

IMPROVED DECOY FOR WILD BIRDS OR FOWLS.—Sportsmen will find interesting a recent invention of a decoy for birds, which may be operated from a distance to rise and fall and to move the wings, thus giving a life-like appearance, and immediately attracting wild birds or fowls. The decoy is mounted on a rod which fits into the tube provided with a pipe at its lower end, whereby the decoy may be anchored. A lug on the rod projects from a slot in the tube, and is attached to a cord which passes over a pulley at the top of the tube and under a pulley at the bottom. Thence the cord passes to the operator, who is concealed. The top of the rod, above referred to, passes freely through the body of the decoy, and its upper end engages a pin attached to the wings, which are hinged to the main body of the decoy. Now, when the operator draws upon the cord, the rod will be raised, lifting the pin and causing the wings to move in a very life-like manner. On further drawing the cord, a pin on the rod is brought into contact with the lower side of the decoy, lifting the decoy bodily from the water.



IMPROVED DECOY FOR WILD BIRDS OR FOWLS.

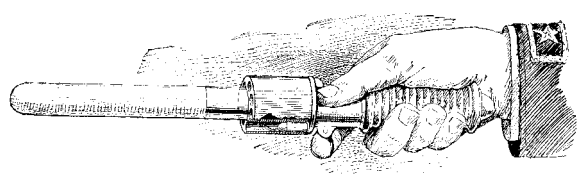
BATHTUB FOR INVALIDS.—It is sometimes a very difficult matter to lift an invalid or a decrepit person into or out of a bathtub of the usual type. A New York woman has invented a new type of bathtub particularly adapted to overcome this difficulty. The tub is provided with a water-tight door at one end, which may be opened to afford entrance to or exit from the tub. The tub is formed with double walls between which the water is first let in and brought to the proper degree of temperature. After the person has entered



BATHTUB FOR INVALIDS.

the tub the door is closed and the water is admitted through a large opening in the bottom of the tub.

POLICEMAN'S MACE.—In certain emergencies it would be of decided advantage to a policeman if he could carry a revolver ready for instant use, without disclosing the fact that he was armed with anything more than the ordinary mace. For such emergencies, a Chicago inventor has devised the combined mace and revolver, which we illustrate herewith. The mace, which is of ordinary appearance, comprises a



POLICEMAN'S MACE AND REVOLVER COMBINED.

handle portion and a club portion, which are screwed together. The handle carries a hammer or trigger mechanism, and when desired the handle and club may be separated and a revolver cylinder applied between them, thus converting the mace into a revolver. However, the revolver cylinder on the club is inconspicuous, and will not be observed except on close scrutiny.

Brief Notes Concerning Patents.

According to the Washington Star elaborate tests of considerable scientific value have been made in the Potomac River of a continuous sounding machine, by which a profile can be made of the river bottom. The value of such a machine will be apparent to almost anyone. The present method of performing this operation is by "heaving the lead," which time-honored process is necessarily crude and incomplete. It has the disadvantage that between two points where a sounding may have been made, there may be quite a considerable obstruction in the shape of a rock or some sunken piece of wreckage, capable of doing serious damage to the bottom of a craft striking it. The device referred to consists of the graduated rod about thirty feet in length, running freely up and down and adjusted to the side of a launch or any character of boat. This is approximately perpendicular to the water, and terminates at the bottom in a wheel of sufficient weight to insure contact with the bottom at any speed otherwise suitable for sounding. By proper adjustment the rod is compelled to roll along on the bottom while maintaining its vertical position, and this is extremely sensitive to any change whatever in the profile of the bottom of the river at the point of the boat's passage. At the test referred to, the device indicated at one point an obstruction which could hardly have been of greater proportions than a barrel half covered in the mud of the river bottom. The device is the patent of a young Marylander now resident in Washington.

Many new thrills and novel sensations are being experienced by the guests at the St. Louis Exposition, and a company has undertaken to put up the great American refreshment, ice cream, in the most novel and convenient form which has ever been devised. This company utilizes the collapsible tube in which paint has been so long sold for the use of artists. This tube was used first for this purpose, and later came into favor for tooth-paste, some forms of soap, and similar commodities. The inventor is of the opinion that this invention will appeal to the great majority of visitors to the Fair, for the reason that it will be a time-saver.

A vestibuled cattle train is the invention of W. A. Buckner, of Cleburne, Texas. This is a device to facilitate the loading and unloading of cattle being shipped alive, and also to provide means by which the cattle may be separated or treated in case of accident or sickness if necessary without the necessity of stopping the train. The arrangement is a very simple one, merely calling for the construction of double doors at each end of the car and a folding platform. As the doors are opened and the platform extended and held in this position by means of hooks, the vestibule is formed, and thus the cattle can be driven in at one end, and may pass the whole length of the train. As each car is filled, the end doors are closed and the cattle allowed to fill the next one. In this manner the train is loaded very rapidly.

One of the trials of the brickmaker is the loss occasioned sometimes by the destruction of the cubes of clay which are in the course of drying, preparatory to being burned. It is said that a year ago, during the prevalence of some unusual floods, the brick-making companies along the Hackensack River lost $10,000 in this manner. A system by which this is entirely overcome has been worked out by H. H. Walsh, who is a brickmaker and a member of the North Jersey Brick Company at Carlstadt, N. J. He has arranged at the works named a continuous drying plant, into which the bricks are placed in lots of fifteen hundred at a time. The bricks are carried along on an endless chain, slowly progressing through the chamber from one end to the other. The moisture in this manner is quickly driven from the green bricks, and when they emerge they are ready for the burning kiln. This drying chamber is operated in a very economical manner, for the reason that the heat is supplied by the exhaust from the boiler.

Despite the fact that in the course of the past two years a number of labor-saving devices have been introduced into the glass factory of Ball Brothers in Muncie, Ind., there are to-day more men employed in the establishment than ever before. Most of the inventions which have been lately installed in this plant are the work of one of its employes, Albert Bingham, who has been exceedingly energetic in devising improvements by which manual labor has been supplanted by machinery. An automatic cut-off attachment which this gentleman is responsible for was given a test a few weeks ago, and its initial operation was pronounced a success from every standpoint. By its use, all the work now done by the "pressers" and "set-up boys" will be performed in an entirely satisfactory manner, and the services of these hands dispensed with. This means, in this particular case, nearly one hundred employes. A year ago, a similar innovation was put into service in this establishment, and a like saving of labor effected; but as stated above, these introductions did not result in actually cutting down the pay roll, for the business of the concern has been so great that additional employes have been taken on from time to time, to enable the firm to keep abreast of the orders.

William Jennings Holman, who was well known in scientific and mechanical circles, died recently at his home in Minneapolis, Minn., at the advanced age of eighty-four years. He had done a number of things which have been the means of attracting public notice to himself, but nothing did this more successfully than the invention and construction of the Holman locomotive speed truck, which has been experimented with by several railroads. The merits of this invention have been the subject of much discussion, but the device never worked its way into any great popularity. Mr. Holman led a remarkably active career, and only a week before his death submitted to the Baldwin Company in Philadelphia the drawings of a locomotive improvement which he had recently invented. He built the old Peru & Indianapolis Railroad, which was the first line in the State of Indiana, and which was constructed in the early fifties, and he occupied the chair as president of the company for a number of years. He also figured in the discovery of the South Park gold fields in the southern part of Colorado.

Legal Notes.

The Rotary Disk Plow in Court.—Rotary disk plows, although they have been the subject of invention for twenty-five years or longer, have only quite recently come into extensive use. They have come in the wake of disk harrows as cultivators of the soil. These plows, as they have been usually constructed, consisted of a frame, generally carried on wheels, in which was located a large concave disk, one or more, of iron or steel, having an edge on its periphery, and revolving on an axle at its center. The vertical plane of the edge of the disk was, in the usual form, perpendicular to the frame and to the soil, but the horizontal plane was turned at an angle to the line of draft, so that when the disk was let down and the machine was moved forward the disk would enter the soil at the same angle to the line movement, and, revolving, would turn out on its concave side a furrow of the earth scraped out by the edge of the disk, the area of earth moved corresponding with the angle at which the disk was set and the depth to which it entered the soil. Provision was made for raising and lowering the disk in the frame or with the frame, and for counteracting the sidewise pressure produced by the movement of the earth on the concave side of the disk, as by the use of sharp-edged wheels entering the soil and running parallel to the line of draft, or by staggered wheels inclining inwardly at the bottom. When more than one of such disks were used they were sometimes set one a little forward of another, and on parallel lines, so as to operate on strips of the soil after the fashion of what are known as gang plows.

Certain objections had been found in such former constructions of these plows which tended to defeat their usefulness and prevented their coming into general use, notably these two: The disk, running in the ground with a perpendicular plane, simply scraped out the soil instead of plowing it, and left the soil in the bottom of the furrow compacted by the scraping; and, secondly, that in order to compel the disk to enter the soil properly it was necessary to carry a considerable weight upon it, which was dead weight, and much increased the motive power required to operate the machine. Some of the most recent patents show columns of extra weights located above the disk to effect the purpose. The principal object of Hardy's invention, the subject of patent No. 556,972, is found in his conception of means for overcoming the defects above stated, though he also stated a purpose "to so arrange the landside wheel relatively to the plowing disk that it shall form a pivoted support by which the plow may be turned easily at the corner or end of the furrow." That patent was made the subject of a suit brought by Sanders v. Hancock (128 Fed. Rep. 424).

His main purpose Hardy accomplished by removing the dead weight hitherto found necessary to drive the disk into the ground, and turning the upper edge of the disk to a backward inclination, so that in operation it would stand not only at a horizontal angle to the line of draft, but also at an angle to the perpendicular plane of its former position. The results of this change were important. The cutting edge of the disk in its lower forward section would enter the ground at an angle more acute, the tendency of which would be to give the disk a dip or "lead" under the soil instead of rolling over it. This dispensed with the weight theretofore put into or upon the machine to impel the disk into the soil. The soil when cut up from below would slide upward and off the concave of the disk in much the same manner as it slides on the moldboard of the common plow, instead of being scraped and crowded off. Both of these features—the lightening of the load and the relief of the obstruction to the movement of the earth in front of the disk—would, of course, diminish the motive power required for the operation. Moreover, the compaction of the bottom of the furrow would be avoided, for the new angle of inclination which Hardy's invention contemplates could be so adjusted that the disk would not be riding upon the bottom of the furrow and dragging over it, but would be lifting off its furrow from the moment it is severed by its cutting edge. After the introduction of this improvement the use of these plows rapidly increased, and they were accorded public favor.

The second claim of the patent, which was the only one involved in the suit above mentioned, reads as follows:

"(2) In a rotary plow, the combination with a plow-beam, of a box-bearing arranged on the plow-beam, an axle rotatable in the box-bearing, a plowing disk secured to the said axle, rotated solely by the natural draft thereof and the friction of the soil, set diagonally to the line of draft and inclined out of a vertical plane for cutting the furrow, and turning the soil therefrom, a furrow wheel mounted on an axle at the same side of the plow-beam as the plowing disk and arranged in advance thereof, an arm pivoted to the rear portion of the plow-beam and provided with a caster-wheel arranged in the rear of the plowing disk, and a stop device for limiting the swinging motion in one direction of the arm carrying the caster-wheel, said furrow wheel and caster wheel being inclined for resisting the side pressure of the plowing disk, substantially as described."

In its physical aspects the change in the position of the disk by Hardy does not seem large, but it was an important one, and contributed much to the final success of these plows.

But this would seem to follow from the shape of the cutting rings, which are very concave.

A patent to Niles, issued in 1882, for "improvements in revolving plows" (so called, but, in fact, revolving harrows), shows the disks set not only at an angle to the line of draft, but also at an inclination backward from the vertical. He describes as his preferred form a disk having a flat working face. But he says, "if it is desired, the disks may be made somewhat dishing, in which case a better moldboard effect will be produced" than with ordinary disks. And he further says:

"Now, when the machine adjusted in this way is drawn forward, this double inclination of the disks will cause them not only to cut into the ground, as shown, but also to turn it over, instead of crowding or scraping it outward from the working face of the disk in the ordinary way—that is, the portion of the disk back of the point or cut will have a moldboard action on account of the inclination downward of its axis of rotation. This moldboard action, whereby the soil is turned in furrows, is obtained to a greater or less degree by changing the angle of inclination of the shaft to the line of progression. . . . As the shafts are inclined backward more and more, the disks cut deeper, and turn the soil over more completely."

It is difficult to distinguish this from Hardy's conception, said the court in deciding the case. It is true it is found in a slightly different kind of machine. But they belong to the same family—a very kindred art. The court thought there was no patentable novelty in Hardy's principal idea, that of the peculiar position of his disk. If it had been new, there could be no doubt it would have made his combinations new and patentable.

What Constitutes Infringement.—The case of the Bullock Electric Manufacturing Company vs. the Westinghouse Manufacturing Company (129 Fed. Rep. 105) brings out a phase of the question of infringement that may be helpful to inventors who are not fully versed in patent law. The facts of the case are briefly these: A preliminary injunction was granted restraining the defendant in an infringement suit from "the making, using, or selling of any apparatus embodying the inventions recited or specified" in the case of three patents. The first two covered combinations of mechanical elements, one element in each being a motor which operated by the method of the third patent, covering such method alone. During the suit defendant made and shipped the motor of the patent to a customer in Canada, with the expectation and intent that it would there be used in the devices of the combination claims of the first two patents and in the practice of the method covered by the third patent. The court held that the defendant was not chargeable with infringement nor guilty of a violation of the injunction. The grounds of the decision are these: The making or selling of a single element of the combination is not an infringement of the patent covering the combination, and not the elements separately; the making or selling of a machine adapted to practise the method of the third patent was not an infringement of the patent; and the use of the patented combinations or the practice of patented methods in Canada was not an infringement of the United States patents, and consequently defendant was not chargeable with contributory infringement.

Exceptional Commercial Success as a Plea for Novelty.—The Ferry patent, No. 574,894, forms the subject of an infringement suit recently decided in the Circuit Court for the Southern District of New York (Ferry vs. Waring Hat Manufacturing Company, 129 Fed. Rep. 389), in which Judge Lacombe handed down an instructive opinion.

The patent in question relates to what are known as hat packing rings or stays. The manufacturers of hats ship these articles in tall boxes, each containing several hats. To keep the hats separate, so that they will not rub against one another, hat packing rings are employed. For many years packing rings of various forms have been in use. Any plain strip of pasteboard of suitable width, curved to conform to the contour of the hats, might be employed for the purpose. Obviously, however, the sharp or rough edge of a piece of pasteboard would chafe the hats wherever it came in contact with them. Prior to the granting of Ferry's patent, various expedients had been adopted to overcome this difficulty. Strips of paper were pasted over the raw edges of the cardboard; or they were bound with flannel or other soft material; or the edges were broken over so that they stood at an angle with the body of the strip, forming a flange or broader strip upon which the hat could rest.

Ferry applied for a patent in 1880, which was issued in 1891, covering a ring of a rigid cylindrical shape, to contain the hat crown, the edges of this ring being curled outwardly so as to present a perfectly smooth, unbroken surface for contact with the crown and brim of the hat.

To use the words of Judge Lacombe, "The evidence establishes with a conclusiveness rarely found in patent suits, that the advance from Ferry's patent of 1891 to the one in suit has produced a marked saving in the cost of manufacture and in the amount of waste, and has vastly enlarged the output field of the manufacturer. The earlier rings had to be completed as rings before shipment; that is, the ends had to be fastened together, or the edges would uncurl. Then, since freight is regulated to some extent by the size of the package, the manufacturer could supply only his immediate neighborhood. The device of the patent may be 'nested' and shipped to remote places, each ring to be there fastened by insertion when put into use."

In view of this evidence, the court granted an injunction and an accounting to the complainant.

Phosphate Baking Powder Decision.—The United States Circuit Court of Appeals in New York has recently rendered a decision sustaining the patent of C. A. Catlin, assignor of the Rumford Chemical Works, covering the use of coarse or granular phosphate in baking preparations.

The facts appear to be that formerly the phosphatic material was in a finely powdered condition, and that the baking powder made therewith rapidly deteriorated. To overcome this difficulty, Catlin used the phosphatic material in a coarse or granular condition.

The vital question was: Did the substitution of the coarse for the fine material constitute an invention? which the court answers affirmatively. In deciding the case, the court defined the difference between the phosphate previously used and that covered by the patent as follows: "The former was essentially free from granular (coarse) phosphatic material; the latter is essentially free from pulverulent (fine) phosphatic material. A percentage of coarse particles was found in the former, and a percentage of fine particles is found in the latter, but the predominating characteristics are that the former was essentially fine and the latter essentially granular."

Presumption from Grant of Patent.—The case of the American Soda Fountain Company against Sample (130 Fed. Rep. 145) involved the validity and infringement of the Sample patent (No. 498,962) for a draft tube for soda fountains. The special feature of the claims involved was the subdivision of a tube extending from the valve into branches, so as to reduce the pressure when it is desired to use the soft stream in filling a glass. These claims were held void for lack of patentable novelty in view of the prior art, especially in view of the Clark patent and the Fergus patent of 1872.

In deciding the case the court stated that the fact of the file wrapper's disclosing the granting of a patent as applied for, without any reference, does not add force to the presumption of novelty arising from the grant, but rather to the contrary, where there were prior patents for devices in the same art, which are obviously closely analogous to that described in the application.

The United States Circuit Court for the Southern District of New York has granted a perpetual injunction to Alexander von Faber-Castell, the sole surviving member of the copartnership of A. W. Faber, against John Eberhard Faber, enjoining him from using the name Faber alone as applied to pencils and stationer's rubber goods, and from using the name Faber Pencil Company or E. Faber Pencil Company. The injunction furthermore restrains the making, selling, and advertising of any lead pencils in which the Faber, or Faber Pencil Company, or E. Faber Pencil Company appears. The Court, however, permits the use of the name Faber when prefixed by "Eberhard" or "John E." or "J. Eberhard." The usual accounting is also granted, whereby the plaintiff is enabled to collect the profits which have accrued to John Eberhard Faber through the wrongful use of the name Faber.

An inventor, in claiming a combination of certain elements, is not confined to the particular form of device of either of them described in the specifications, but is entitled to anything of the same general character which is a mechanical equivalent.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

WATERPROOF ENTRANCE - BUSHING FOR WIRES.—W. B. HOPKINS, Providence, R. I. In this patent the invention relates to a device for running wires into buildings and closed spaces of various kinds without the possibility of water entering the conduits. The improvement also serves to prevent the abrasion of the wires and is provided with means whereby it may be readily mounted upon poles, buildings, etc., whereby the wires may be readily placed in position.

TOOL FOR INSERTING WIRES IN SLEEVES.—H. BEAUDETTE, Troy, N. Y. The invention pertains particularly to devices for use in forcing electric wires, such as trolley-wires, into coupling-sleeves, an object being to provide a tool for this purpose that will be simple in construction, inexpensive, and by means of which the wire ends may be easily inserted.

Of Interest to Farmers.

PLANTING ATTACHMENTS FOR PLOWS.—D. GORDON, Dallas, Texas. The purpose of this inventor is to provide a beam having adjustable supporting-wheels capable of being raised and lowered to bring the driving-wheels into engagement with the ground or raise them from it and to provide means for independently raising and lowering the driving-wheels to permit the plowshare to enter the ground more or less deeply and also to provide a simple driving connection between the driving-wheels and the seed-distributing device employed for planting.

POTATO-SORTER.—O. P. HALLOCK, Mattituck, N. Y. In this instance the aim of the invention is the provision of a new and improved sorter which is simple and durable in construction, very effective in operation, and arranged to sort the large potatoes from the smaller ones and to separate the dirt from the large potatoes.

STOCK-WATERING DEVICE. — F. C. MUDD, Ellisgrove, Ill. The object in this case is to provide an improved device arranged to pump water to a trough or like receptacle through the agency of the animal stepping up to the trough to drink. After drinking, the remaining water in the trough is automatically discharged, so that each animal receives its own fresh-water supply in the trough.

Of General Interest.

COASTING DEVICE.—W. F. CLARK and P. T. PERRAULT, North Adams, Mass. This device is especially adapted for the use of children. Upon the upper end of a standard, rising from a runner, a seat is carried. Placed upon the seat the rider grasps the sides, raises the shoes from the snow and slides upon the runner, maintaining a balance in a vertical position. Wear and tear upon shoes is largely saved by not touching them to the snow during coasting. It is possible to readily turn or to dismount to avoid collision.

CAMERA-SUPPORT.—M. GRAF, Tuckahoe, N. Y. The purpose here is to provide details of construction for a support which are practical and inexpensive, affording convenient means for quickly and reliably adjusting parts of the same to spread apart and hold the legs of a tripod at a desired degree of divergence and also enable the accurate adjustment of details for elevating, depressing, or leveling the body of the camera as may be necessary for its proper use.

DRAWING INSTRUMENT.—E. S. JOHNSON, Lincoln, Neb. This instrument is capable of use for drawing ellipses and circles of various sizes, and ellipses of all shapes and sizes within the limits prescribed by the length of the body piece, which can be made in sizes to suit needs, so that it can be used for drawing semicircles of any radius by the expedient of setting the two slides in contact at their contiguous edges, which brings the two points of attachment of the flexible connection into substantial coincidence. This connection adjusts in length at a projection through instrumentality of a spring and bar.

BRIDLE-BIT.—C. C. KING, Little Rock, Ark. This invention is in the nature of a bridle-bit for kicking, balking, or runaway horses; and it consists in the construction and arrangement of parts of the device whereby an extreme tension put upon the reins is made to so adjust the parts of the bit as to pinch and close the nostrils of the horse, and by cutting off his supply of air reduce him to subjection.

CHEEK-PLUMPER.—OLIVE L. MAYES, Evanston, Wyo. In this patent the invention has reference to toilet articles for personal wear; and it consists of a packer or plumper for filling out the hollow of each cheek of the human face, thereby improving the personal appearance of the wearer under conditions the most comfortable.

SHIRT-WAIST HOLDER AND SKIRT-SUPPORTER.—FANNY K. OTTENHEIMER, New York, N. Y. The purpose in this instance is to provide a very simple, economic, and readily-applicable device which may be made independent of the shirt-waist and removably attached thereto and which may be detachably connected directly to the shirt-waist so that the device may be quickly and conveniently disconnected from the shirt-waist, enabling the latter to be laundered without obstruction.

TYPE - CARRIER FOR CYLINDER PRESSES.—C. S. ROSIN, Tacoma, Wash. This improvement pertains to presses employed for printing wooden boxes and the like; and the object is to provide a carrier arranged with movable types, leads, spaces, border-bars, etc., to allow convenient changing of the subject-matter to be printed and to permit readily setting up the matter and attaching the carrier to the cylinder of the press.

DEVICE FOR DRYING THE HAIR.—LILLIAN SWAIN, New York, N. Y. This collapsible device has means for attachment to the shoulders and chest, the body portion being in the shape of one or more horizontal bows of a non-corrosive material and arranged when the device is upon the person to support the hair, spread, and hold it out from the point of juncture of the neck with the head, completely freeing the neck and permitting free passage of air around the neck and through the hair. The hair dries rapidly and uniformly, and the garments are protected from drippings.

CABINET.—D. J. SWEET, Pittsfield, Mass. Mr. Sweet's invention pertains to improvements in cabinets particularly adapted for holding envelops containing the pay of workmen in business establishments, an object being to provide a very simple and convenient means for assembling and delivering the wages of employes.

SUSPENDERS.—I. WECHSLER, New York, N. Y. The invention refers particularly to improvements in devices for attaching suspender-ends to the main straps or webs, the object being to provide an inexpensive attaching device so arranged that the button-engaging ends will yield with the swinging motion during the movements of the wearer's body, thus not only relieving strain on the suspenders, but relieving pressure on the shoulders.

Heating and Lighting.

COMBINED CRUCIBLE AND PREHEATER.—J. A. AUPPERLE, Indianapolis, Ind. In this patent the invention relates to crucibles and to apparatus used in connection therewith. Mr. Aupperle's more particular object in carrying out the improvement being to produce a preheater in combination with a certain type of crucible in which said preheater is supplied with purified air.

INCANDESCENT HYDROCARBON-LAMP.—S. GRANT and T. L. STEWART, Portland, Ore. The invention relates to improvements in lamps with a retort-vaporizer constructed to return the hydrocarbon-vapor to a point below fuel-inlet and on same side of lamp on which fuel-inlet is located, the feed-tube leading into a canopy and the feed-tube and the jet-tube being in the shape of a V, and both of said tubes being straight, or nearly so, so as to enable one to easily clean both of said tubes and to insert and renew the wire-gauze or other packing when needed.

BURNER.—A. G. KAUFMAN, New York, N. Y. In this patent the invention has reference to Bunsen burners; and its object is the provision of a new and improved burner which is simple and durable in construction and arranged to produce an exceedingly powerful heating-flame with a comparatively small amount of gas. The device may be utilized for various purposes; for instance it may be arranged as a soldering-iron.

Household Utilities.

COMBINATIONAL CHAIR.—D. HOECKE, New York, N. Y. This portable chair may be readily folded and admits of a considerable variety of uses. It can be adjusted into quite a number of different positions, so that its general purpose may be changed by gradations, thereby being able to serve as a couch or an ordinary rocking-chair, or it may partake to some extent of the characteristics of both a rocking-chair and a couch.

SINK-STRAINER.—H. G. LAWRENCE, Salt Lake City, Utah. The objects of this invention are to provide a strainer which shall be capable of application to any sink, which requires no change of the pipes in order to put it in place, which can be easily removed for cleaning purposes, and which can be manufactured at very small expense and be thoroughly efficient to accomplish the desired objects.

FLAT-IRON HEATER.—W. J. LE BARRON, Barre, Vt. In this patent the invention refers to means for temporarily incasing a plurality of flat-irons used for laundry purposes while they are subjected to heat radiating from the top of a stove, and has for its object to provide novel details of construction for a flat-iron heater which adapt it for very effective service and afford a neat, compact and inexpensive device.

MACHINE FOR SHAPING SAW-TEETH.—J. MCMASTER and D. D. MCMASTER, Seattle, Wash. The invention relates to a machine for shaping saw-teeth, and more particularly to a type of machine especially suitable for shaping the teeth of circular saws while in motion. The invention permits of quite a number of adjustments. Files may be adjusted so that the saw-teeth are rendered uniform in length and thickness. The operation may be readily performed after the teeth have been swaged for sharpening.

WINDOW CONTROLLER AND LOCK.—G. MCDOWELL, New York, N. Y. The purpose here is to provide a device adapted for attachment to the meeting-rail of the lower sash, for example, and for frictional binding and locking engagement with a side rail of the upper sash, so that the two sashes may be locked together, though opened at the top and bottom to any desired extent. A further purpose is to construct the device so that either sash may be independently operated and so that, further, when the two sashes have been closed in the window frame the device will automatically act to lock and secure the sashes in their closed position.

Railways and Their Accessories.

APPARATUS FOR LOADING GRAIN-CARS.—E. L. ADAMS and A. C. ADAMS, Edgar, Neb. The purpose of the inventors is to provide a simple, durable, and economic form of apparatus especially adapted for loading grain into cars and to so construct the supply-head of the apparatus that the grain can be directed to any point in a car, so as to produce an automatic leveling of the grain and obviate the usual manual labor required for such purpose.

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

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

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

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(9459) E. G. S. asks: What is meant by cutting lines of magnetic force? A. To answer your inquiries, which really cover almost the entire field of electrical science, we will begin with the last, which should have been first. We recommend and can furnish you with Swoope's "Lessons in Practical Electricity," price $2, by the study of which all the questions which you ask will be answered and many others which you will need to know before you will be an intelligent worker in electrical work. 1. Lines of magnetic force (Swoope, page 14) are a very useful invention to express the strength of a place in the region affected by a magnet. A certain magnetic strength is said to be equal to 1 line of force, because a magnet pole would be pulled there with a certain force. 1,000 lines mean 1,000 times the pull on a magnet of the same strength. The strength of all magnets is represented by these lines. They are not real lines, any more than the equator of the earth is a real line; they are a very convenient invention to express magnetic force. When a coil or piece of wire passes through a place affected by a magnet the wire is said to cut the lines of force of that magnet. 2. Which are the positive and negative poles of a zinc and carbon cell? A. The end of the zinc which projects out of a battery cell is the negative pole, and the end of the carbon which projects out of the cell is the positive pole of the cell. (Swoope, page 54.) 3. Why does a current have to flow back to a cell again? That is, why does not one wire do just as well as two—one wire having both ends split for contact? A. A connection of the plates outside of the liquid of a cell is necessary to produce electricity in the cell by chemical action of the liquid on the zinc plate or rod in the liquid. Why this is so is not easy of explanation, nor is it necessary to know the reason, in order to know the fact. 4. How do you attach a wire, and of which pole from a battery to charge a Leyden jar? A. You cannot charge a Leyden jar from a chemical battery of cells unless you have many thousands of cells connected in series. Then you would connect the positive pole to one coating of the jar and the other coating to the negative pole of the battery and the jar would be charged. There is not electrical pressure enough in a few cells to drive electricity into a Leyden jar so as to produce a spark from the jar. 5. If a thick copper wire carries electricity easier and with less resistance than a thin one, why are thin ones used for bell work? A. Thin wires are used for bell work because they cost much less than thick ones and will do the work just as well by using some more cells on the line. The reason for using thin wires instead of thicker ones in any place is one of cost. It is cheaper to furnish battery than to pay for copper. But very thin wires are not used for bell work. They would require too many cells for economy. A balance is struck by using a wire about No. 18, not too thin nor too thick. 6. If two wires are heavily charged, that is dangerous to touch, how could an arc or incandescent lamp be connected to same without shutting off current and without getting a shock? A. If wires are carrying a heavy current it is not possible to touch them without danger of shock. Wiremen wear rubber gloves, and use rubber handled nippers for such work. 7. How can a person without any knowledge whatever of electricity know which wires are dangerous and which are not? A. No one with or without knowledge of electricity can tell whether a wire is safe by looking at it simply. 8. If street railway rails are connected by copper wires at the joints, with feed wire suspended above the street and also another small wire above each feed wire, which takes the return current back to the power house—the wire above the feed wire, or the rails; and if not the rails, why are the joints of rails connected by copper wires? A. The small wires above the trolley wire of a street railway line are for the purpose of preventing any outside wire which may happen to fall upon the line, from striking the trolley wire. They carry no electricity. The rails carry the return current through the wires which connect them. 9. What is meant by induction? A. Induction (Swoope, page 293) is the influence a wire carrying a current

has to produce another current in other wires in its neighborhood. By it all dynamos generate their currents; all induction coils produce their effects. The action is by means of the lines of magnetic force which was the subject of question 1. 10. If a wire gets overcharged why does it get heated, and what causes it? A. All wires are heated which carry an electric current. More current, more heat. A wire resists the flow of electricity through it, and the force necessary to push the electricity through a wire heats the wire. 11. A live wire 150 feet long has two other wires connected to it, each 50 feet long and 50 feet apart, and each in opposite directions to each other; each wire has four lamps, and last 50 feet of wire has also four lamps; lamps all the same and the same distance apart. Which lamps get the most power—the ones nearest the source of power, and if not, why? Kindly explain in full. A. The lamps nearest the source of current get the most current and are brighter than those further away. The mode of wiring shown in your diagram is for the purpose of equalizing the distances as much as possible. Swoope, page 426, gives some instruction about this. 12. Why does an alternating current flow in one direction and then in another or opposite direction; and when lamps are connected to same, why do they not go out when current is flowing away from them, and *vice versa?* A. An alternating current does not flow away from the lamps at any time. It flows through them in one direction and then through them in the other direction, but is going through them all the time in some direction. As the alternations are very rapid, too rapid for the eye to see, the lamp does not show the changes in current. With 120 alternations per second no one can see the flicker of the lamps; if there were only 10 per second every one could see the light rise and fall, as the current changed its direction of flow. 13. Knowing that a dynamo makes electricity from power and a motor makes power from electricity, how can a person know the difference between a dynamo and a motor by simply looking at same? A. There is no electrical difference between a dynamo and a motor. One may often be used for the other. A motor may often be told from a dynamo by knowing the usual shapes given to the two sorts of machines. 14. Why are connections with batteries, etc., made with the wires coiled like a spring? A. Connections with binding posts are made by coiling the extra wire in a spiral for the looks of the thing. Such a disposition of the extra wire presents a better and more finished appearance than to leave the wire hanging loosely and in unshapely loops. 15. Does electricity flow through a wire or around it, and if around it, why does not the electricity from one wire connect with all the others on a rainy day by following the water on a telegraph or telephone pole from wire to wire, as water is a good conductor? A. Electricity of low potential flows through the wire and produces a magnetic field around the wire. High potential electricity flows along the surface of the conductor and does not penetrate the body of the metal to any great degree. 16. What does single phase, polyphase, etc., mean? Having no knowledge whatever about electricity, and intending to work at same, you will greatly oblige me by answering the above questions. Can you give me the names of some good books, also prices of same on electricity? I mean books with the why, how, and wherefore of electricity, so that it can be understood by an average person. All the books that I have seen on the subject explain it too high up for one that does not know the theoretical and practical side of it. What I want to get at is the main underlying points of it, so that I can work up from same. A. Single phase, etc., are terms which refer to the shape of the waves of alternating-current electricity.

(9460) W. W. F. asks: Will you please inform me, if possible, where I can purchase a glass for examining the bottom of a lake where the water is about 30 feet deep, but clear. I understand such glasses are used but have never seen them advertised. A. A water telescope consists of a tube or box with glass in one end and the other open. It may be six to eight inches in diameter, large enough for both eyes to be used in looking into it. The inside should be painted a dull black and the whole may be three or four feet in length. It is placed in the water with one end under water, and the observer looks down through the glass tube into the water. The philosophy of the thing is that the ripples upon the surface of the water cannot affect the water in the interior of the tube, therefore the surface of the water in the tube is still and the eye can see clearly to considerable depth. It is not a telescope in the ordinary sense, but a simple and useful appliance for its designed purpose. A good quality of plate glass should be employed in the end of the tube. We are not aware that these instruments are on the market.

NEW BOOKS, ETC.

IN SEARCH OF A SIBERIAN KLONDIKE. As narrated by Washington B. Vanderlip, the chief actor, and herein set forth by Homer B. Hulbert. New York: The Century Company, 1903. 12mo.; pp. 315. Price, $2.

Mr. Vanderlip, engaged by a Russian firm to make an extended prospecting tour in Kamchatka, meets with a series of experiences and adventures that, as recounted by Mr. Hulbert, make delightful reading. Doubtless in the actual experience there were thrills that were not altogether of delight. To have yourself and your sledge run away with by the pack of fourteen dogs, to be buried in a blizzard and to spend five days in a snow dugout, to fight millions of mosquitoes on the banks of the Paran River—these escapades, mildly exciting to read, must have been anything but blissful in the living.

WIRELESS TELEGRAPHY: ITS THEORY AND PRACTICE. By William Maver, Jr., ex-Electrician of the Baltimore and Ohio Telegraph Company; Member of the American Institute of Electrical Engineers. New York: Maver Publishing Company, 1904. 8vo.; pp. 216; 123 illustrations. Price, $2.

This book was begun several years ago as an appendix to the author's "American Telegraphy and Encyclopedia of the Telegraph;" but the rapid progress of the art of wireless telegraphy made Mr. Maver decide to publish it as a separate volume. The book follows, as far as practicable, the general lines of the former work. Each subject has been treated both from a theoretical and practical standpoint, in language as free as possible from formulæ, and which is intelligible to the general reader. The descriptions of systems and apparatus has been limited almost entirely to those in active operation, but any operating devices of note which have escaped the attention of the author, owing to the rapid advancement of the art, he expects to describe in a later edition. The book gives a comprehensive statement of all that appertains to wireless telegraphy as at present developed, and it forms a complete practical handbook.

REPORT OF THE ELEVENTH MEETING OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Edited by Calvin M. Woodward, C. Frank Allen, and Clarence A. Waldo. New York: Engineering News Publishing Company, 1903. 8vo.; pp. 379. Price, $2.50.

This volume contains the addresses given at the Eleventh Annual Meeting of the Society, which was held in joint session with the American Institute of Electrical Engineers, the first three days of July, 1903, at Niagara Falls, N. Y. Among the important papers contained in the book is the last from the pen of the late Prof. Robert H. Thurston, of Cornell University, on "Educational Values and our Modern Liberality in Education." The book also contains a valuable report by a committee upon technical books for public libraries. Some twenty other papers on engineering, electrical, and technical subjects are contained within its pages, which are bound in a neat blue cloth cover. The index to the first ten volumes, as well as any of these volumes, can be had of the publishers at reduced prices for libraries throughout the country.

PRINCIPLES OF AMERICAN FORESTRY. By Samuel B. Green. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1903. 12mo.; pp. 334. Price, $1.50.

The author is Professor of Horticulture and Forestry, University of Minnesota, and a member of the Forest Reserve Board of the State of Minnesota. His intention has been to furnish information of an elementary and basic character for the student and the general reader. "The Tree," "The Forest," "Forest Influences," "Propagation," "Nursery Practice," "Forest Protection," and "Forest Problems," are some chapter headings indicative of the nature and scope of the work. A tabular classification, a glossary, and a detailed index complete the volume.

REMINISCENCES OF GENERAL HERMAN HAUPT. Written by Himself. New York: John R. Anderson Company, 1901. 8vo.; pp. 331. Price, $1.75.

This is an autograph edition, each copy being numbered, and signed by the talented author. We use the adjective advisedly. Gen. Haupt has made his influence felt in many branches of activity; as a designer and builder of bridges; as a constructor of railroads and tunnels; as an inventor; as a military strategist and civil counselor; as a railway manager; as a manufacturer. Hence the wide appeal of these reminiscences. As Chief of the Bureau of United States Military Railways in the civil war, his personal interviews with the President and with the generals in command of the armies in the field gave him the opportunity of acquiring inside knowledge, and of forming opinions as to the great movements of the war. These views are set forth in a clear and convincing manner.

THE NEIGHBOR. The Natural History of Human Contacts. By N. S. Shaler. Boston and New York: Houghton, Mifflin & Co., 1904. 12mo.; pp. 342. Price, $1.40 net.

The author of "The Individual" and "The Interpretation of Nature" here gives us conclusions arrived at after careful, conscientious study of facts and conditions which we are accustomed to dispose of in the term "race prejudices." Our attitude toward the Jew and the Negro is analyzed, and serious consideration given the question of overcoming unwarranted bias with a view to accepting, in its completeness, the idea of the brotherhood of man, and thus of amalgamating those interests, at present antagonistic because viewed from various racial angles, which make up the commonwealth. These problems constitute a most important group, and Prof. Shaler's standing, and the scholarly work he has already done, entitle the statements and deductions of the present volume to a thoughtful hearing.

READY REFERENCE TABLES. Volume I. By Carl Hering, M.E. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1904. 16mo.; pp. 196. Price, $2.50.

These are tables designed for the use of the engineer, the physicist, the student, and the merchant, with conversion factors of every unit or measure in use. The calculations are based on the accurate legal standard values of the United States. The system of tabulation is somewhat novel and ingenious; instead of the usual rather cumbersome arrangement, all interconvertible units are found together, placed in the order of their size.

IRRIGATION ENGINEERING. By Herbert M. Wilson, C.E. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1903. 8vo.; pp. 573; 41 full-page plates and 139 figures. Price, $4.

In view of the reclamation law enacted by Congress, whereby two and a half millions of dollars are annually to be devoted to "public works other than those for river and harbor improvement," the subject of irrigation assumes increased importance to the engineering profession. The work before us is a fourth edition, revised and brought up to date, treating in a thorough manner of the various laws of hydrography, and of the usages in canal works and in storage reservoirs.

DESCRIPTIVE CHEMISTRY. By Lyman C. Newell, Ph.D. Boston: D. C. Heath & Co., 1903. 12mo.; pp. 590. Price, $1.20.

The volume is divided into two parts. The first comprises a description of the elements and their important compounds; the application of chemistry to well-known industries; the newer processes involving electricity; the theory of chemistry; tables and bibliography. The second part contains experiments; one hundred and fifty are given, requiring only inexpensive apparatus. The aim has been to produce a textbook that shall be more complete, better balanced, more serviceable to the student, and more helpful to the teacher, than any other available. It comes to us highly commended by several of the leading college professors of chemistry.

MICROSCOPIC ANALYSIS OF METALS. By Floris Osmond, C.E., Paris. Edited by J. E. Stead, F.R.S., F.I.C., Middlesbrough. London: Charles Griffin & Co., Limited. Philadelphia: J. B. Lippincott Company, 1904. 12mo.; pp. 178; with 100 photographic illustrations and two folding diagrams. Price, $2.50.

Two papers of Monsieur Osmond's are here published, the first under the title of "Metallography as a Method of Assay," the second dealing with "Micrographic Analysis of Carbon Steels." Not only has this well-known investigator authorized the publication of the English translation, but he has written for it a description of his microphotographic apparatus and the method of using it, which appears as an appendix to the volume. The chief value of this work on metallography lies in the positive accuracy of the experimental observations. One may disagree with some of the hypothetical conclusions, although they have yet to be disproved; but their truth or falsity does not affect the observations and experiments on which they were based; these have been repeated time and again with unvarying results, and are now universally accepted as a part of metallographic knowledge.

CYANIDING GOLD AND SILVER ORES. A Practical Treatise on the Cyanide Process. By H. Forbes Julian and Edgar Smart. London: Charles Griffin & Co., Limited. Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 405; with numerous illustrations and folding plates. Price, $6.

Much information relating to the industry of cyaniding gold and silver ores has been published in periodicals of the day or read, in the form of papers, before various societies; but a great part of such information is, by reason of its ephemeral nature, practically inaccessible to the student and investigator. Here we have a good deal of this fragmentary research brought together in a systematic way, and the result is a work of reference that the practical worker will greatly appreciate. Engineers of indisputable ability and standing have furnished data relating to methods and to cost, and have in other ways helped to make the manual inclusive of all that has so far been accomplished in the industry.

USES OF ELECTRICITY ON SHIPBOARD. By J. W. Kellogg. New York: Marine Engineering, 1904. 12mo.; pp. 78. Price, $1.

This small volume gives just the information needed by yacht and launch owners who wish to make use of electricity for lighting, operating winches, etc., on board their vessels. The information it contains is thoroughly practical and deals with the selection and care of an engine and generator, methods of wiring, and complete installation of a plant. In the chapter by D. A. Richardson on electric lighting of launches is discussed the use of storage batteries for this purpose. This chapter also contains a diagram of the wiring of a launch. The book contains a number of illustrations of engines, dynamos, and switchboards, as well as a diagram showing the wiring of a small steamship.

A TEXTBOOK ON STATIC ELECTRICITY. By Hobart Mason, B.S., E.E. New York: McGraw Publishing Company, 1904. 12mo.; pp. 155. Price, $2.

The author was moved to the preparation of this textbook by the apparent lack of any adequate work of the kind. "The subject of Static Electricity," he says, "is touched on in the average 'Physics' or 'Natural Philosophy,' in a most gingerly fashion." In textbooks devoted to Electricity the subject seems to be almost entirely avoided. His material appears to be well arranged and free from ambiguity of statement, and progresses naturally from general phenomena to a consideration of high potential static generators.

A MANUAL OF MARINE ENGINEERING. Comprising the Design, Construction, and Working of Marine Machinery. By A. E. Seaton. With Numerous Tables and Illustrations reduced from Working Drawings. London: Charles Griffin & Co., Limited. New York: D. Van Nostrand Company, 1904. 8vo.; pp. 707. Price, $6.

We have had occasion to refer to this manual for information on several points not usually covered by books on marine engineering, and have in each instance found these points noted and disposed of in an able manner. The author was formerly lecturer to the Royal Naval College of Greenwich; the engines of the destroyer "Salmon," designed by him, are shown in one of the admirably clear plates distributed throughout the volume. Even a condensed table of contents would be too long to give here, but it would be hard to find any subject, in any way related to the main theme, that has been overlooked or excluded.

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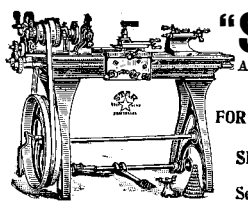

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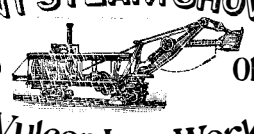
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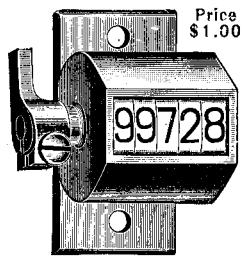

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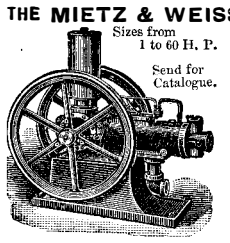
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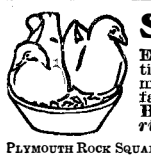
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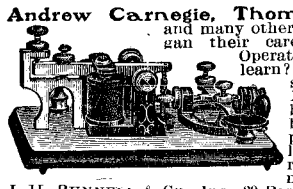
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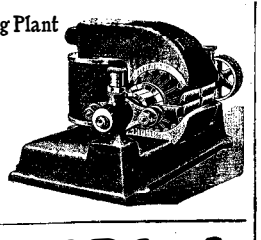

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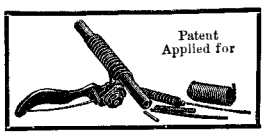

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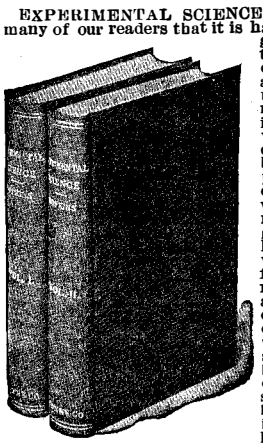

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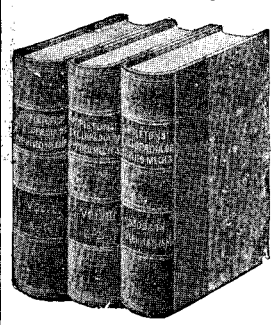
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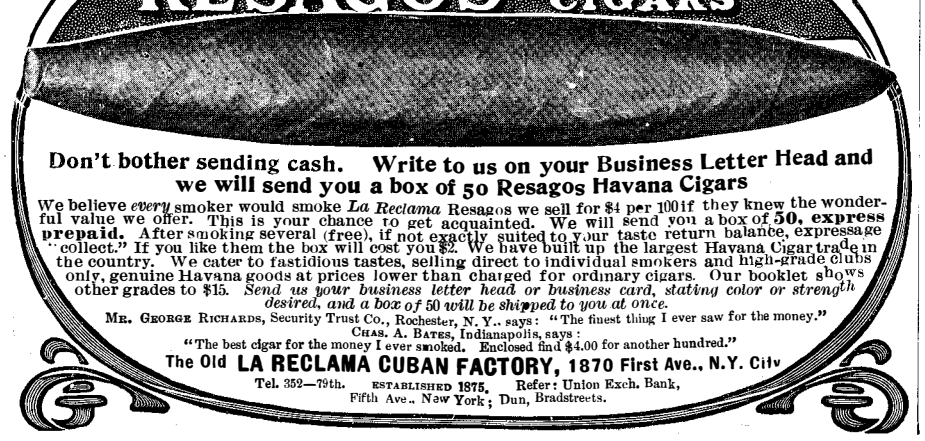
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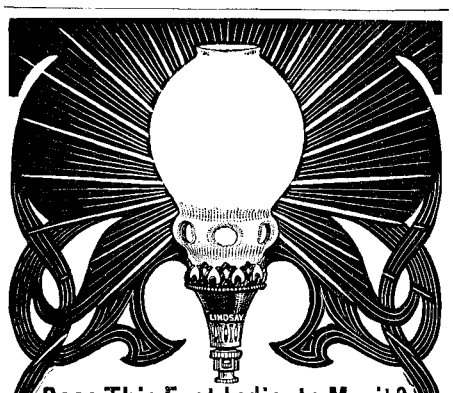

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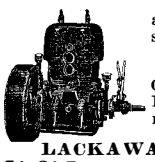

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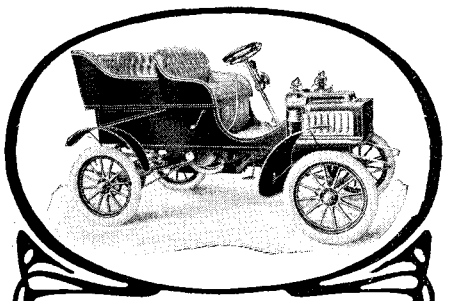

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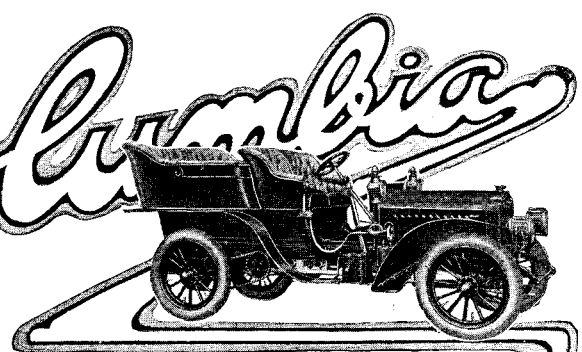

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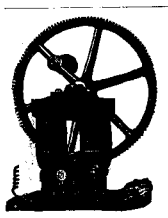

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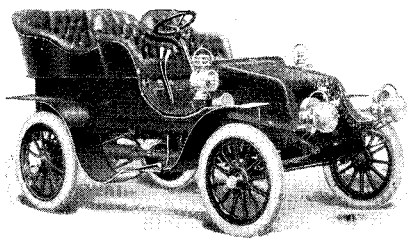

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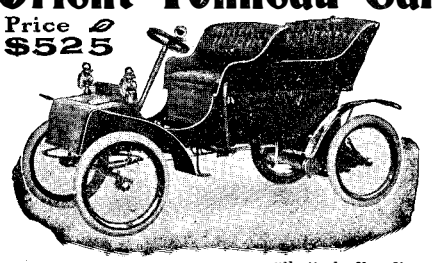

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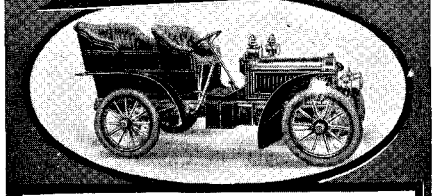

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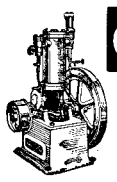

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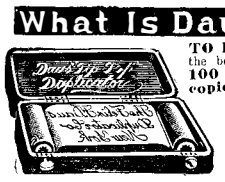

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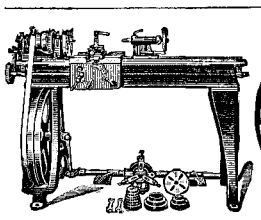

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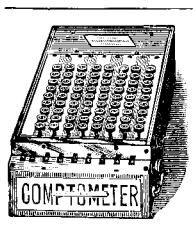

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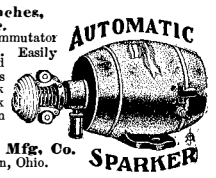

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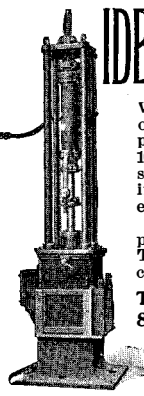

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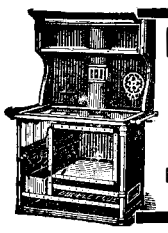

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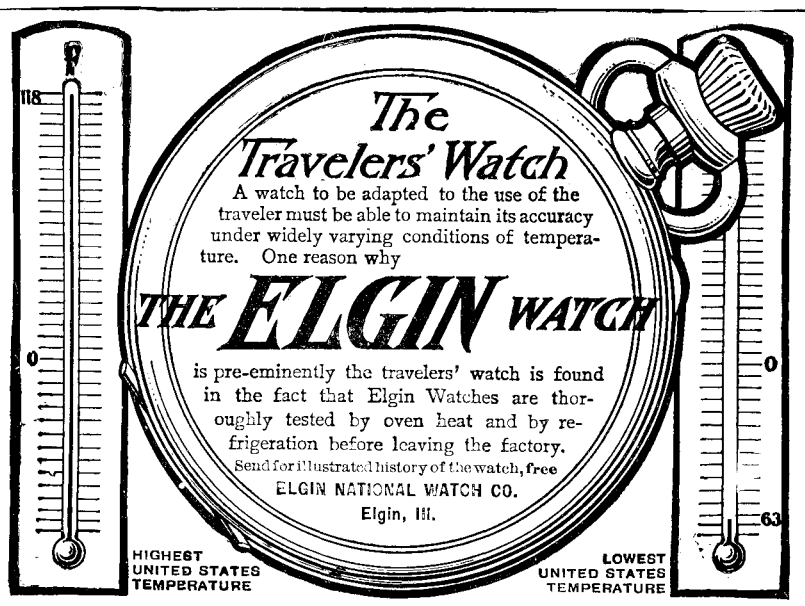

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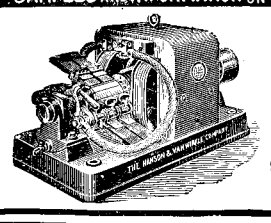

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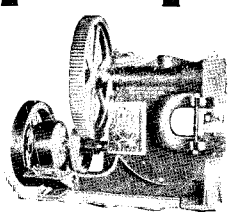

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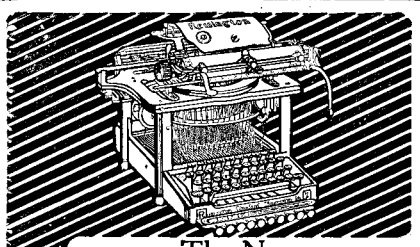

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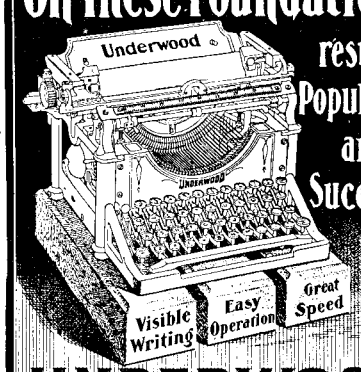

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