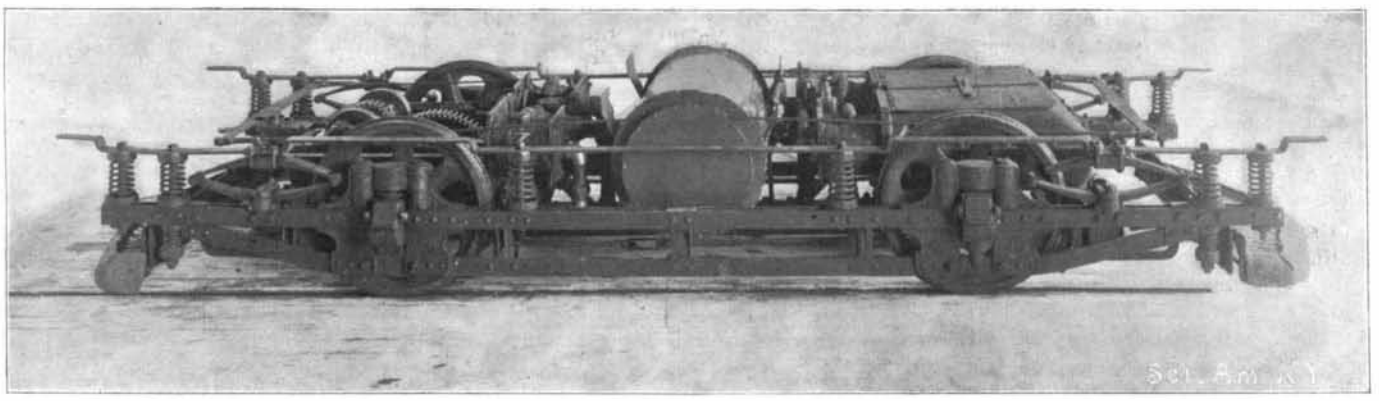
THE HOADLEY-KNIGHT COMPRESSED AIR MOTOR.

In our last issue we gave some account of the development of compressed air traction on the streets of New York city, and drew attention to the fact that experimental and practical work in this direction had been done with two motors, one known as the Hardie motor having been run on several cars on the One Hundred and Twenty-fifth Street line of the Third Avenue Street Railway Company, and the other, built under the Hoadley-Knight patents, having shown good results in operating several cars on the Lenox Avenue branch of the Metropolitan Street Railway Company's system. In the Hardie motor compressed air is used in a single, two-cylinder, high-pressure engine. It is carried in steel reservoirs, located under the seats of the car, and on its way from the reservoir to the motor the air is heated by passing it through a tank of hot water, stored under a pressure of several hundred pounds to the square inch.



COMPOUND, COMPRESSED AIR MOTOR TRUCK, AS USED ON STREET RAILWAYS.

The Hoadley-Knight motor differs from the Hardie type chiefly in the methods of heating the air and in the fact that the motor is on the compound system. The superior results obtained with the Hoadley type have led to a combination of two companies into the new American Air Power Company, which controls all the patents of both systems, and is now actively engaged in building and supplying the Hoadley-Knight motors for all classes of work.

Our illustrations show a plan view and a photographic reproduction of one of the motors which was successfully at work on the Lenox Avenue line. It will be seen that the truck is of the type ordinarily used for electric cars, and it is one of the advantages of this compressed air motor that it does not involve any structural alterations to the truck to put it in place. The weight of the car when it is equipped is about the same as that of an electric car, the car body weighing 6,500 pounds, the truck 4,500 pounds, the reservoirs 3,600 pounds, the complete motor 3,000 pounds, and the other fittings bringing the total weight of the car up to between 18,000 and 19,000 pounds.

It will be seen from the plans that the power is applied to both axles, the high pressure cylinders driving one axle and the low pressure cylinders the other. The cylinders are, in each case, attached to the outside of a strong, cast-steel casing, which entirely incloses the moving parts of the motors. The lower part of the casings in each case serves to hold a bath of oil, which renders the engine self-lubricating and, because of the close-fitting cover, entirely dust-proof. The high pressure cylinders are 4 inches in diameter, the low pressure cylinders 8 inches, and the common stroke is 6 inches. The crankshaft carries a 9-inch pinion which meshes into a 23-inch gear-wheel on the axle of the car. The hot water tank is placed transversely to the truck and between the cylinders, as shown in the engraving of the complete truck. The supply of compressed air, stored at 2,400 pounds pressure, is carried in a set of cylindrical steel reservoirs, which are placed beneath the seats in the car. From these it is led by a combined throttle and reducing valve, at a pressure of 320 pounds to the square inch, to a coil which is located within the hot water tank, in which the water is under a pressure of between 225 and 300 pounds to the square inch. In passing through the coil the temperature of the air is raised to an extent which greatly increases its capacity. On its way from the coil to the high pressure cylinder a spray of hot water is thrown into the now heated air, in which it is immediately converted into vapor. The combined steam and compressed air then enter the high pressure cylinder. The high pressure exhaust is heated by passing it through the hot water coil, and before the reheated air enters the low pressure cylinders, another spray of hot water is injected into it. The temperature of the air as it issues from the low pressure exhaust is sufficient to prevent any trouble from freezing and choking up the exhaust passages.

AUTOMOBILE CARRIAGE DRIVEN BY COMPRESSED AIR MOTOR.

The power is controlled by a single lever at either end of the car. When it is thrown over in one direction, the car is propelled at a speed corresponding to the distance through which the lever is moved. When the lever is reversed, the car is stopped, and a further movement in the reverse direction will reverse the motors. With regard to efficiency, it may be said that, in the diagrams showing the work of compression and expansion, the area of the compression cards is 2·015 square inches, and the area of the cards of both high and low pressure cylinders is 1·227 square inches; from which it is seen the compound compressed air motor shows an efficiency of 60·9. It has been found that, owing to certain losses not shown in the diagrams, as a matter of fact, about 35 per cent of the indicated power of the compressors is delivered on the axle of the car in driving the motor. Fifty per cent of this economy is estimated to be due to the reheater and careful tests have shown that the cost of reheating is about one-fifth the cost of compressing the air. It requires thirty to forty pounds of free air to drive a nine-ton twenty-four foot car, and the cost of compressing and reheating the air and of the maintenance of the motor works out as 2·9 cents per car mile.

In view of the large amount of publicity which has been given during the last few weeks to the financial affairs of the motor company and what is known as the auto-truck company, the public would naturally be led to suppose that the auto-truck was in successful service on the streets of our large cities. This is not the case. The only actual compressed air auto-truck in existence as far as we have been able to learn is the crude yard truck shown in the accompanying engraving.

EXPERIMENTAL COMPRESSED AIR AUTO-TRUCK FOR YARD.

The Hoadley-Knight motor, it is true, has been applied to an automobile carriage of the kind shown in our engraving, which has the appearance of being a compact and serviceable vehicle; but the auto-truck, so called, exists as yet only upon paper. Plans, however, have been prepared and the company has purchased the Rhode Island Locomotive Works for the purpose of manufacturing cars and motors.

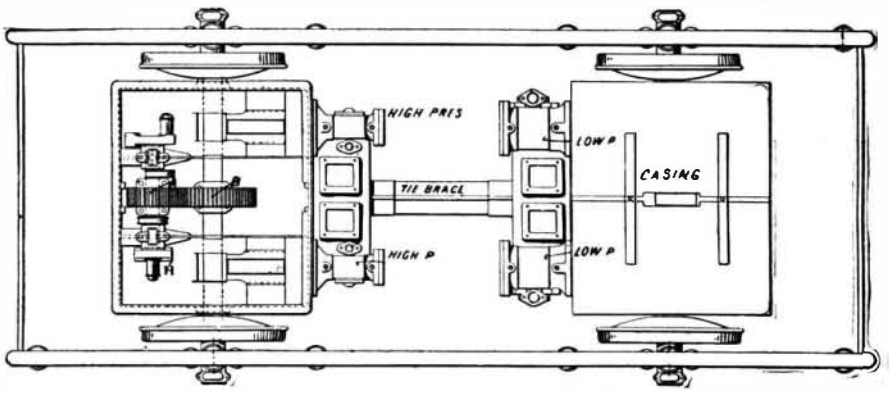
Report of the Smithsonian Institution.

The report of Prof. S. P. Langley, Secretary of the Smithsonian Institution, for the year ending June 30, 1898, has just appeared. Following the precedent of several years, he has in the body of the report given a general account of the affairs of the Institution and its bureaus, and, as usual, the report teems with interesting particulars of the splendid work which is to be accomplished by this branch of the government service. The receipts for the year were $67,178.22, of which $56,400 was derived from the interest of the permanent fund in the Treasury and $10,778.22 was received from miscellaneous sources. The total permanent fund now amounts to $912,000 and is deposited in the Treasury of the United States. During the year 1897-98, Congress charged the Institution with the disbursement of appropriations for exchanges, ethnology, the preservation of the National Museum, the preservation and care of the collections, maintenance of the buildings of the National Zoological Park, the Astro-Physical Observatory, etc., in all $363,097.

The promotion of original research has always been one of the proper functions of the Institution. Investigations in the anthropological, biological, and geological divisions of science have been extensively carried on through the departments of the National Museum and through the Bureau of American Ethnology, these lines of research being well represented by its bureaus. It has remained for the Institution proper to devote its energies more specially to some of the physical sciences. The secretary himself has carried on researches in the solar spectrum which are believed to be important, and the results of which will shortly be published. The secretary has not wholly discontinued the studies he has made in regard to aerodromic experiments, and these have attracted the attention of other departments so far that during the war with Spain a commission was directed by the Secretaries of War and the Navy to inquire into them with a view of their possible utility in war. The secretary's time is now so largely given up to administrative work that what he has been able to do in these directions has been largely done in hours which might be considered his own. Grants were made from the Hodgkins Fund for carrying on work at the Blue Hill Meteorological Observatory and to a number of professors at home and abroad for carrying on investigations upon the air and other gases.

In the plan of organization of the Institution, exploration occupies an important part, and during the year investigations among American Indians have been conducted by the Bureau of Ethnology, and several collaborators of the Institution have made natural history explorations. As usual, the Institution has published a number of interesting books and pamphlets, among which may be specially noted Dr. H. C. Bolton's "Catalogue of Scientific and Technical Periodicals," a monumental work, second only to his "Bibliography of Chemistry." The library quarters at the National Museum have been increased, and during the year nearly 5,000 volumes were added. The Smithsonian deposit at the Library of Congress is known to number something like 350,000 titles, and the work of classification and cataloguing is being actively carried on.

At the International Congress of Orientalists, which was held in Paris, September, 1897, and at the International Geological Congress, held at St. Petersburg, September, 1897, the Smithsonian Institution was represented by delegates. The Institution participated in the Tennessee Exposition by a proper exhibit. The National Museum has, during the year, received 4,141 lots of specimens, which include more than 450,000 objects. This is worthy of special notice, as this increase is the largest during the last fifteen years, and it manifests a desire on the part of the public to aid in building up the collections. The number of specimens now recorded in all departments of the Museum is considerably more than 4,000,000. Nine thousand four hundred and fourteen institutions in other countries are in communication with institutions in the United States through the Smithsonian Institution, and the Report is accompanied by a map showing the distribution of correspondence of the Smithsonian international exchange services. The weight of matter sent out during the year exceeded 150 tons and was distributed among 93 countries. Work has also proceeded on the National Zoological Park and at the Astro-Physical Laboratory. The amount of work carried on by the Smithsonian Institution is enormous, and the quality of it is so high that there is no branch of the government service which is so widely and warmly recognized abroad as the Smithsonian.



PLAN SHOWING ARRANGEMENT OF MOTORS, GEARING, AND CASING.

Patented Works at the Paris Exposition.

Fears have been entertained by some American manufacturers, who intend to have exhibits at the Paris Exposition, that their inventions, registered designs, trade marks, etc., will not be protected by the French government. It is satisfactory to note that Mr. A. S. Capehart, Director of the Liberal Arts and Chemical Industries for the United States Commission to the Exposition, who recently returned from Paris, states that he was assured that the inventions, trade marks, etc., of the American exhibitors would be amply protected. Mr. Capehart has obtained considerable information in regard to the subject from the French authorities, which he will publish in a pamphlet which will be issued by the commission for distribution among manufacturers. He states that the French law of 1868 is explicit, and that this law is incorporated in the organic act of the republic providing for the exposition. The law is in relation to all exhibitors, and guarantees ample protection to those who have not previously exhibited their manufactured articles in the republic of France for a period of three calendar months next following the close of the exposition, provided such exhibitor, within thirty days after the opening of such exposition, make or shall have made application for a patent. Mr. Capehart also quoted from the general rules and regulations of the exposition. In the chapter concerning the protection of the exhibits are the following provisions:

Section 70. No works of art, no products exhibited in the buildings, parks, or gardens, may be sketched, copied, or reproduced, in any way whatsoever, without an authorization from the exhibitor countersigned by the department of the director-general. The commissioner-general may give permits for the reproduction of ensemble views.

Section 71. Exhibitors shall have all the rights and immunities granted by the law of May 23, 1868, as to the guarantee of inventions liable to be patented, and also of manufacturing designs, within the delays and subject to the conditions of the said law.

Gun Metal for Jewelry.

Gun metal is at the present time very popular for match boxes, cigarette cases, watch cases, lorgnettes, etc., for which silver has been the prime favorite for several years. The New York Tribune recently had an interesting article on the subject.

Gun metal is made up not only in plain, undecorated form, but also in combination with gold, and is used in the handsomest pieces as a background for jewels. A quantity of gun-metal jewelry was imported from Europe a few months ago. A few manufacturers at once began experiments with a view to duplicating the same, but they soon found themselves not successful in obtaining the dull, soft luster which distinguishes the blackish surface of the metal. Lacquering, oxidizing, and varnish failed to give the desired finish, and the coatings wore off very rapidly, and for a while it seemed as though the foreigners would enjoy their monopoly; but at last an Italian who had been engaged many years in making fine jewelry in gold and silver, after a long series of experiments discovered the process, and, strange to say, he is almost the only man who can now produce a satisfactory article of this kind in this country. Naturally, he will not disclose the valuable secret, but he gave the writer of the article referred to a general idea of the method of treating the metal. He first procures the high-grade steel used by the government in the manufacture of artillery, so that it is really "gun metal," and proceeds to fashion it into the various forms desired. The metal is then, of course, of the ordinary light gray color which characterizes steel, and to produce the dull black luster a long process of finishing must be undertaken. The workers refer to the first step in the process as "taking all the rust off the metal." This is done by boiling it in hot acids. After being soaked for some time in one solution, the article is taken out and dried, when the rust appears upon it as a dull, reddish-brown coating. This is then filed off. After every trace of brown has been removed, the piece is immersed in a second solution, taken out, dried, and filed as before. These alternating soakings and filings are repeated five or six times, until there is not a trace of rust left. The last filing and polishing leave it in the proper condition, and it is then ready for sale, unless it is to be mounted with gold or precious stones. It is very difficult to put on hinges, etc., as it is very hard to solder it properly. As only the most expert workmen can be employed, this accounts for the present very high price of the gun metal articles. It is an unfortunate quality of this beautiful substance that when exposed to much dampness it will rust after a time, despite the care with which it is made.

Viticulture in Russia.

Although the results of last year's grape harvest, especially in the Crimea, were disappointing—a fact due to unfavorable weather and to the ravages of the phylloxera—viticulture in Russia has within the last fifteen years made enormous strides, says The English Mechanic. At one time confined to the southeast of the Crimea, it now extends in a northerly and northeasterly direction into the provinces of Kherson, Podolia, and Bessarabia, some of the plantations, notably that of Prince Troubetzkoi, covering an area of 500 acres.

In the government of Bessarabia, in particular, the progress made, according to the acting British consul-general at Odessa, has been very marked, both in the extent of land under cultivation and in the quality of wines produced. The former fact is brought out by a comparison of the area under cultivation in 1893, which amounted to 108,000 acres, and that in 1897, which was 175,000 acres. The latter fact is evident when we consider that a province which at one time produced only wine rated as very inferior has now gained a reputation for the quality of its superior wines, which are quite equal to good quality French wines, over which they have a considerable advantage in point of price.

The causes militating against the wine harvest in the Crimea have also been present in Bessarabia, so that the finer quality wines are this year more limited in quantity and higher in price than in a good season. The quality of the Bessarabian wines, both red and white—the red bearing a close resemblance to Burgundy, the white partaking of the nature of hock—should render them acceptable in England and other countries, and it is confidently believed that in course of time Russian wine will compete with effect on the markets of Europe; in fact, it may be worthy of note that it figured in 1897 among the exports from South Russia, when the first shipment of the kind was made to the British Isles. The development of viticulture has led to the establishment in Odessa of two champagne factories. One of these has not yet commenced operations, but the other has been working under most favorable circumstances for some time, competing most successfully with French champagne.

The Launching of the Cruiser "Albany."

The United States cruiser "Albany," which was purchased from Brazil about the middle of last March, was launched at Newcastle, England, on January 14. The vessel is the sister ship of the "New Orleans," which we have illustrated in the SCIENTIFIC AMERICAN for April 9, 1898. Her length is 330 feet; the moulded breadth is 43 feet 9 inches; the maximum draught is 16 feet 10 inches; her displacement is 3,600 tons; the horse power is 7,500; and the coal capacity is 850 tons, giving a steaming radius of 8,000 miles. The armament consists of six 6-inch rapid-fire guns, four 4·7-inch rapid-fire guns in the main battery. The secondary battery is composed of ten 6-pounders, four 1-pounders and four Maxim rapid-fire guns. The cruiser is also fitted with three torpedo tubes. Fortunately the vessel was purchased at a time when the construction could be altered somewhat to adapt the vessel to our needs. The improvements are largely in the matter of ammunition hoists and in providing more comfortable quarters for the officers and crew, as a vessel which is intended for the tropics is very uncomfortable in our northern climate, as has been found in the case of the "New Orleans," which was built for use in southern waters.

SZCZEPANIK, the Polish schoolmaster, who is the alleged inventor of the alleged instrument for enabling one to see an object at a distance clothed in the colors of nature, announces that by means of an electrical device which he has invented, he can, by it, with the aid of a beam of light, explode bombshells. Our contemporary The Electrical Engineer, from which we glean this interesting intelligence, calls this "another fern from Szczepanik's garden." The instrument which is supposed to annihilate distance and enable us to see our friends in foreign lands is known as the "fernschr."