new concrete bridge is being built to replace an old steel truss affair, and this bridge will be ready for crossing this fall. It is 110 feet long and 200 feet wide, covering the entire intersection of the streets referred to. Above Fourth Street the company's dredges are taking out the final bench of rock to widen the canal, and next spring the Fourth Street bridge will be taken out and a new structure put in. Thus by August next the work that has been under way more than a half century will have been completed.

The company is under contract to furnish the Pittsburg Reduction Company 37,000 electrical horse-power from the new station early next year. The Pittsburg Reduction Company has completed the foundations of a very large new works to the north of the forebay site, between the New York Central tracks and the edge of the high bank.

It will be recalled that at the hearing before Secretary of War Taft in Niagara Falls on July 12 last, the Niagara Falls Hydraulic Power and Manufacturing Company asked permission to divert 6,400 cubic feet of water per second from the upper river. The secretary later gave the company a permit to use 4,000 cubic feet, but it is understood that the additional 2,400 cubic feet will be allowed as soon as the company has this new plant ready for operation.

ARCHDEACON'S AIR-PROPELLED MOTOR BICYCLE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

M. Ernest Archdeacon, well known in Paris for his experiments with aeroplanes, has lately brought out a curious apparatus in the shape of a propeller-driven motor-cycle. This he constructed in order to make experiments upon different forms of blades and show their efficiency. He claims that the propeller, when well designed and adapted to the apparatus which it is intended to propel, has an efficiency which is to be compared with other forms of mechanical transmission. To show what can be done in this direction he built the present machine, which is certainly original and one of the first of its kind. What is more, it travels at a surprising speed. With a small air-cooled motor revolving the propeller, the latter pulled the bicycle and its rider—a combined weight of 335 pounds—at a speed of very nearly 50 miles an hour in an official trial made on September 12 over a stretch of good road not far from Paris. A number of persons, together with the official timekeeper, were on hand to see the test. The new bicycle, mounted by the champion Anzani, is shown in our engraving.

At the middle of the frame is mounted a Buchet two-cylinder light air-cooled motor, with the cylinders mounted in V-shape on an aluminium crank-box. The motor will give six horse-power. It is located crosswise of the frame. On the shaft is a small pulley, from which a triangular-section belt passes above to a larger pulley. The latter is mounted directly upon the long shaft of the propeller, which runs in two ball-bearings fixed to the frame and a third or outer bearing which is held to the frame by two long rods. On the end of the shaft is fixed the large aluminium propeller, which has perforated blades covered with gold beater's skin. A hand wheel is mounted at the back end of the propeller shaft so as to control the propeller for starting and stopping. A gasoline tank and spark-coil complete the outfit, and the whole is very light, weighing not more than 150 pounds.

Anzani took his place in the saddle and set the motor going, and then brought the propeller up to full speed. Even before reaching the top speed of the propeller the motor-cycle commenced to move, first at five miles, then at ten miles an hour, and soon began to run at a high speed. An official test of the speed was then made by two timekeepers. On a second run Anzani made a fine rush over the ground at full speed, and succeeded in covering a kilometer in 42 2/5 seconds, or at a speed of 49¼ miles an hour.

As to what is the practical use of such an apparatus, M. Archdeacon thinks that it will be of great utility in ascertaining the comparative values of different propellers, so as to find the best form and adjust the blades at the proper angle. These tests can be very quickly carried out, more so perhaps than with most

Excavating the Power House Site.

other methods, and one propeller is soon taken off and another one substituted for it. In any case such a combination, which enables a good part of the motor's power to be transmitted to the propeller, is a novelty and may lead to other results of value either in theoretical or practical work. If a machine could be constructed with the propeller located directly on the engine shaft, there would be no loss in speed reduction from the engine to the propeller, and the full engine power would be had at the blades. Then the speed actually obtained compared with the speed which should be made with the horse-power developed by the engine, would give directly the efficiency of the propeller.

How Waste is Turned into Money.

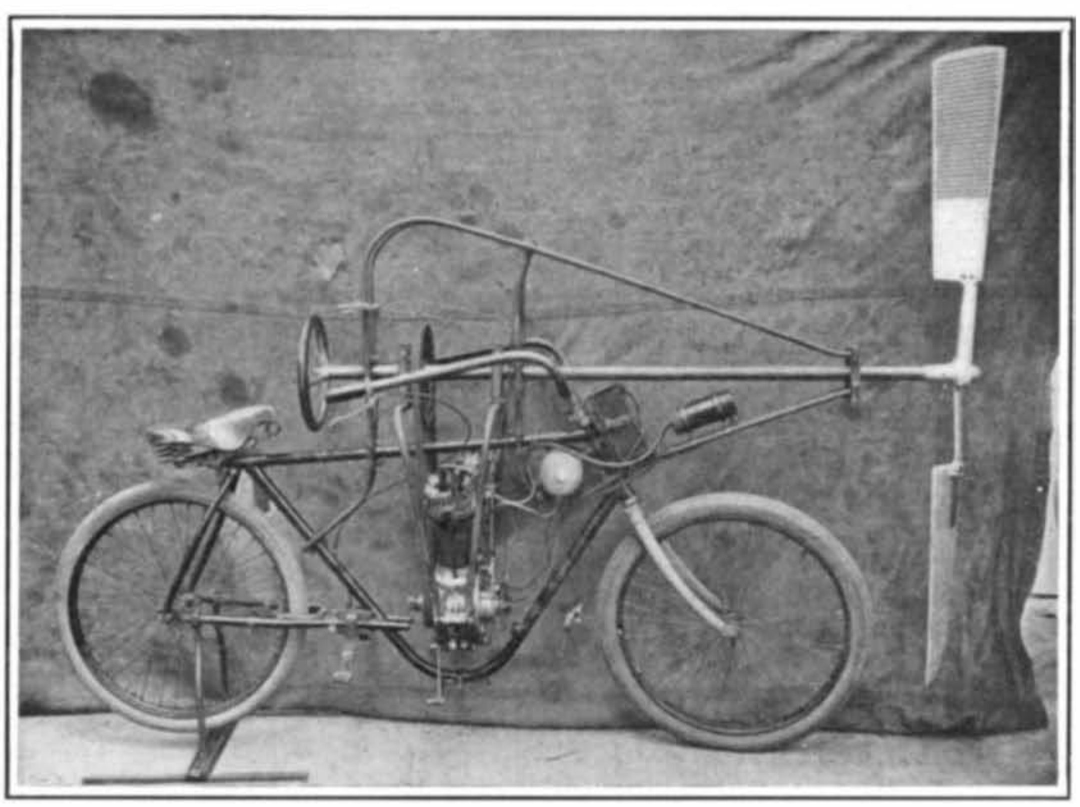
In a discussion of waste utilization it is customary to begin with that shining example of what can be accomplished along these lines—the coal-tar industry. A few years ago the thick, black, viscid liquid which condenses in the pipes during the distillation of gas from coal, was not only waste and useless, but its removal was a positive nuisance and a source of trouble and expense. To-day this tar on further distillation yields a series of products each of which is the basis for a valuable chemical manufacture. Among these products are paraffine, naphtha, benzol, creosote, anthracene, carbolic acid, naphthalene, and pitch. Basic oil of coal tar is the source of the splendid aniline colors, the various hues of which are due to the oxidation of aniline by means of acids or other chemicals. The utilization of some of these products has called into being entirely new industries in the manufacture of dyes, perfumes, medicaments, antiseptics, paving materials, and fuels.

It is undoubtedly true that no branch of science has contributed more to our knowledge of the waste values than chemistry, and a very large number of the great advances have been made along chemical lines. One of the most important of these was Le Blanc's discovery that the treatment of chloride of sodium—common salt—with sulphuric acid gave hydrochloric acid and sulphate of soda. This led to the upbuilding of one of the world's greatest industries of to-day, that of soap making, which formerly had been limited to the soda derived from the sulphuric acid manufacture. Hydrochloric acid, at first a waste, was soon found to be a valuable agent in bleaching. Originally, however, this use was not extensive, and it was necessary to employ a decomposing agent to obtain the chlorine from the acid. This agent was binoxide of manganese; and while the products of the decomposition other than chlorine were at first allowed to go to waste, a complete system of reclamation was soon developed.

The use of furnace slag, in former years not only useless but expensive to remove as well, is becoming more general for various commercial purposes, and the field for further development is excellent. At present, quantities of this material are made into bricks, paving stones, cements, and used as fertilizer. Slag wool, made by blowing steam through a stream of melted slag, is a splendid heat-insulating material. The heat in the slag as it runs from the furnace has also been used in various ways. A good example of metallurgical waste utilization is found in the production of pure tin, good weldable iron, ammoniac, and Prussian blue, from the waste clippings of white iron. The introduction of the gas engine offers excellent means for employing waste blast-furnace gases, though these have previously been made use of in other ways.

Few indeed are the industries which have developed utilization of by-products to such a state of perfection as has the slaughtering industry. It is no exaggeration to say that the animal slaughtered is used from the tip of the horn to the hair at the end of the tail. The quantity and variety of the products from formerly useless portions of the carcasses are almost incredible. Some of these are gelatine, glue, fertilizers, hair, bristles, neat's foot oil, bones, horns, hoofs, glands, and membranes from which are obtained pepsin, thymus, thyroids, pancreatin, parotid substances, capsules, etc.; soap-stock, glycerine, isinglass, albumen, and hides, skins, wool, and intestines.

On This Curious Machine a Speed of 49¼ Miles an Hour Was Made.



Side View of Bicycle, Showing Arrangement of Motor and Propeller-Shaft.

TESTING AN AIR PROPELLER BY USING IT TO DRIVE A MOTOR BICYCLE.

The lumbering industry now turns most of its waste products to useful purposes. The principal one of these wastes is sawdust, and this troublesome material now yields many valuable articles. One of the comparatively recent enterprises in this direction is the distillation of sawdust resulting in acetic acid, wood naphtha, wood alcohol, gas, oil, charcoal, and tar, the last yielding the bases for certain aniline colors. The sawdust may be burned in special furnaces or mixed with other material to form fuel. It is made into artificial wood, used in the manufacture of explosives, of heat-insulating material, in plaster, and largely in paper making. In the paper industry, too, many substances, wastes in the past, are usefully employed to-day. The recovery of the sulphite liquor from wood-cellulose factories has been the subject of many researches and inventions; and while numbers of these are ingenious and partially successful, much still remains to be done in this field. The paper manufacture now utilizes hundreds of thousands of tons of old newspapers, old stock, waste paper, etc., which would otherwise be practically valueless.

The utilization of wastes on an enormous scale, but of which the general public knows very little, occurs in the woolen industry. The principal articles of waste are woolen rags and wool grease. The first are reconverted into wool, and used again and again in the manufacture of cloth in an endless untraceable circle. The wool grease is employed in many industries and yields oils, fats, acids, potassium salts, and other elements of recognized value in arts and manufacturing. It is estimated that the enormous quantity of nearly 3,000,000 pounds of potassium carbonate are saved annually from the wool-wash waters of the mills and scouring establishments of France and Belgium. Waste soap-suds from textile factories yield many valuable substances, such as lubricating oils, fats, acids, and soaps. In one German establishment the suds are precipitated with lime, the coagulum is collected, pressed into bricks, dried, and heated in gas retorts. A gas is obtained which has three times the illuminating power of coal gas, and which in quantity is nearly double what is required to light the entire plant.

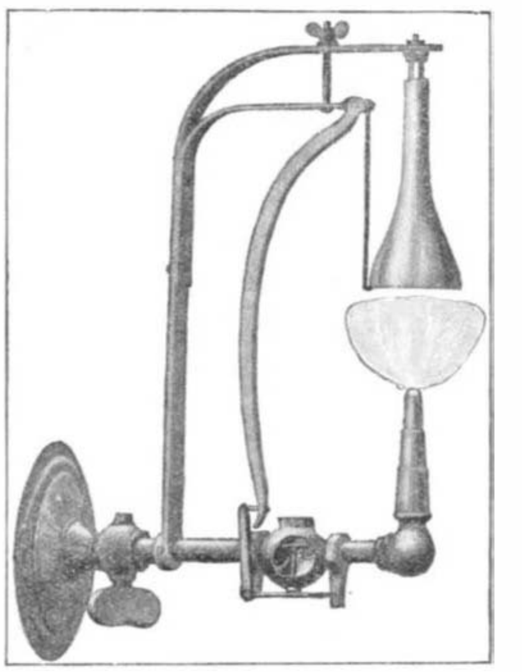
The cotton-seed oil industry can hardly to-day be considered the utilization of a by-product, though such was its origin, for at the present the annual value of the products derived from it is many millions of dollars. The fine cotton fiber still adhering to the seed after ginning, and known as linters, is used largely in the making of mattresses, pillows, felt hats. etc. The hulls of the seeds are used as cattle food, as are also the residues of the meats after the oil has been pressed from them. The pressed meats are also used as a fertilizer. The oil is used in the manufacture of lard compounds, salad and packing oils, soaps and washing powders, and is generally recognized to-day as a high-class food product.

Among other industries in which former by-products have become of the greatest value are those of dyeing, in which the manufacture of synthetic indigo is perhaps the highest attainment yet reached in this field, silk working, starch making, soap making, and brewing. The disposition of the garbage of cities, in the past often presenting much difficulty to the municipalities and frequently even a menace to public health, is remarkably successful from a sanitary as well as an industrial standpoint. From it are obtained valuable greases, fuels, and fertilizers, which often more than pay for the entire cost of operation. An interesting and valuable development is the production of coatings and sizings for paper, water-proof glues, paints, substitutes for hard rubber, horn, and ivory, from the casein, albumen, and milk sugar of skimmed milk. The list of examples of by-product utilization would not be complete without the mention of the use of corn pith for naval purposes, the manufacture of artificial stone from broken glass and from ashes, sash weights from tin scrap, cattle food from brewery residue, new rubber from old, glycerine from distillation washes, and the valuable corn oil as a by-product from breweries, distilleries, and starch works. Remarkable as is this brief account of waste utilization—and but a portion of the later advances have been touched upon—a great deal still remains to be accomplished in many branches of science and industry, and the future undoubtedly will see such an accomplishment, for there is nothing without an economic value for some purpose, if not in the industry in which it first appears, in some other where it can be turned to account.

It is a noteworthy fact in proof of the progress made by the German iron industry that the number of the workmen has not risen in proportion to the increase of the production. In 1895 the production amounted to 5,500,000 tons, and the workmen numbered 24,059; in 1904 the production had risen to 10,000,000 tons. and the number of the workmen only to 35,284. In 1895 the quantity produced per head of workmen employed amounted to 227 tons, in 1904 it had risen to 283 tons; that is to say, the number of workmen increased during the decade by 47 per cent, but the quantity produced increased by 84 per cent.

AUTOMATIC DEVICE FOR TURNING OFF THE GAS.

While the public has been pretty well educated to the dangers of "blowing out the gas," accidents from this cause are still of not infrequent occurrence. Now, however, it is seldom that the gas is deliberately blown out, but the flame is often extinguished accidentally by a strong draft, or the gas may be temporarily cut off for the purpose of repairing the mains, and then turned on again without due warning to sleeping inmates. In order to obviate such dangers, Mr. Iver C. Peterson, of 759 38th Street, Brooklyn, N. Y., has invented a controlling device for gas burners, which operates to shut off the flow of gas when the gas flame is extinguished. As shown in the accompanying engraving, the device comprises a standard, secured to the gas bracket, and supporting a bell-shaped thermostat directly over the burner. The standard also carries a spring arm, to which a bell-crank lever is pivoted. One arm of the lever is very short, and is connected by a hooked wire to the lower edge of the thermostat. The other arm is very long, and extends downward to the gas bracket. In addition to the usual valve, the fixture is provided with an auxiliary valve of the poppet type. The stem of this valve rests on a hinged plate, and the latter carries an arm which engages the longer arm of the bell-crank lever. Normally, the plate is tilted downward, permitting the valve to remain closed. When lighting the gas, the main valve is first opened, and then the hinged plate is raised to open the auxiliary valve. The plate is held up for a moment or two, or until the thermostat is expanded by the heat sufficiently to draw down the shorter bell-crank arm and swing back the longer arm, thereby holding the plate in its upper position. Now, should the gas flame be extinguished, the thermostat would contract, permitting the bell-crank lever to return to its normal position and allowing the plate to drop, whereupon the poppet valve would close, cutting off the flow of gas.



AUTOMATIC DEVICE FOR TURNING OFF THE GAS.

The Third Race for the Vanderbilt Cup.

As a result of a protest made by the makers of the Frayer-Miller racer (which was running splendidly in sixth place when the elimination race of September 22 was called off) this American air-cooled machine has been placed upon the team instead of the Pope-Toledo car, which was running fourth at the finish, but was in so crippled a condition that it would probably have been unable to complete its final round ahead of the Christie and Frayer-Miller cars. As the Haynes car (which gave an excellent demonstration of steady, smooth running) is too low-powered a machine to stand any chance with the foreign racers of double its power, its owners, showing their good sportsmanship, will doubtless withdraw it and allow its place to be taken by a more powerful car. Possibly the second Locomobile racer, which has been held in reserve, will be substituted for the Haynes machine, in view of the fine showing of the first racer in the elimination race. This would seem to be the most rational change, provided a suitable driver could be found for the second racer, as it is as powerful and carefully constructed a car as its mate, which showed the greatest speed of any car in the trial race.

As we go to press, the following is the list of eighteen cars that are expected to start in the third Vanderbilt Cup race at 6 A. M. October 6. The start and finish of the race will be at the grand stand located on the Jericho turnpike about a mile east of Westbury. The race will be of the same length as was the elimination trial, viz., 297.1 miles, consisting of ten rounds of the 29.71-mile course.

No.	Car.	H. P.	Driver.	Entrant.	Nation.
1	Thomas.	115	Le Blon.	E. R. Thomas.	United States
2	Panhard.	120	Heath.	Panhard-Levassor.	France.
3	Mercedes.	120	Jenatzy.	Robert Graves.	Germany.
4	Fiat.	120	Lancia.	F. I. A. T.	Italy.
5	Frayer-Miller.	110	Lawwell.	W. J. Miller.	United States
6	Hotchkiss.	130	Shepard.	Hotchkiss Co.	France.
7	Mercedes.	120	Luytgen.	Geo. McK. Brown.	Germany.
8	Fiat.	120	Nazarro.	F. I. A. T.	Italy.
9	Locomobile.	110	Tracy.	S. T. Davis, Jr.	United States
10	Darracq.	100	Wagner.	A. Darracq.	France.
1	Mercedes.	120	Keene.	Foxhall Keene.	Germany.
12	Itala.	120	Cagno.	Itala Co.	Italy.
14	Haynes.	60	Harding.	John Haynes.	United States
15	Clement-Bayard	100	Clement.	Clement-Bayard.	France.
16	Fiat.	120	Weillschott	F. I. A. T.	Italy.
17	Christie.	50	Christie.	Walter Christie.	United States
18	De Dietrich.	120	Duray.	A. de Turckheim.	France.
19	Itala.	120	Fabry.	Itala Co.	Italy.

Automobile Notes.

An automobilist of great experience suggests that it is a good idea for the driver of a car to show his companion on the front seat how to switch off the ignition current in case the driver suddenly becomes incapacitated. By this simple operation, the car can quickly be stopped, and the damage it is liable to do if it runs wild will be reduced.

The subject of motor racing cannot be left without referring to the undoubted benefit which long-distance racing was to the motor industry. The keen contests which took place between maker and maker and between nation and nation, have resulted in its being discovered by constructors that cars can, by the use of the very best material, be constructed within weight limits which would not have been admitted as theoretically possible by consulting engineers ten years ago. Since 1901, however, there has been a feeling that the time would come when the racing of purely racing machines would cease to be of particular advantage in the design and construction of touring cars. The Automobile Club of Great Britain therefore started last year a new form of racing for what is called the Tourist Trophy, in which the cars have to be *bona-fide* touring cars, affording a certain amount of seating capacity, and carrying four passengers or their equivalent weight on chassis of not less than a certain weight. The speed of the cars is limited by the fuel allowance, the same quantity of fuel being given to all the competing cars. The car which completes the distance in the shortest time, that is, the car which can most efficiently transmit the power obtained from the motor to the road wheels and can cover the distance without running out of petrol and without delay, is the car which wins. It is thought by many experts that this new form of racing is likely to considerably improve the construction and design of touring cars, inasmuch as it compels makers to study the question of efficiency rather than to obtain speed out of their cars by means of engines which are unnecessarily large in order to overcome the inefficiency of transmission.

Vice-Consul Charles Karminski reports a formula fixed upon by the German government as a basis or gage for getting at the horse-power of gasoline or alcohol fed automobiles. He writes:

A memorial, subscribed by a large number of autocar builders and addressed to the imperial treasury department, acknowledges their unanimity on the point of accepting the following formula for determining the horse-power of autocars, viz.: N equals 0.3 id^2s, in which N signifies the horse-power to be ascertained; d, diameter of cylinder; i, number of cylinders, and s, stroke. The formula is based on an allowance of 3.8 kgs. to the sq. cm. (54 lbs. per sq. in.) as the mean pressure of the piston and 900 revolutions per minute, and has been pronounced satisfactory by the technical department of the imperial treasury. The "Mitteleuropäische Motorwagen-Verein" (Automobile Association of Central Europe) has agreed also to accept this formula, which, according to the imperial treasury, will be recognized by the administrators of taxes in the federal states until the respective supplementary clause has been added to the provisions of the imperial stamp law. The proposed formula is applicable, however, only to gaging the horse-power of autocars fed with gasoline or alcohol, in which connection it is left with the builder of or dealer in such cars to supply the buyer with an authenticated certificate from the factory, showing the horse-power of each car, arrived at by means of the formula in question.

Relative to ascertaining the horse-power of electric motors, investigations are now on foot, the result of which will be duly enunciated upon their termination. To determine the horse-power of the old types still in use, the numbers which in most cases builders place on the name plates of their cars will be considered as authoritative. Should the tax-payer in such cases, however, declare the horse-power of his car to be less, he will be expected to prove the actual horse-power by producing a satisfactory certificate from some competent authority