THE DISINFECTION OF SCHOOL BOOKS.

BY JACQUES BOYER.

Although our age prides itself on obeying all the laws of hygiene, many of the administrative regulations which are actually in force directly violate these laws. In the primary schools of France, the books pass annually from one pupil to another, without any attempt being made to prevent the propagation of contagious diseases in this way. Now, despite the good wishes and efforts of the teachers, the personal cleanliness of the pupil is not always above suspicion. The children often come to school with soiled garments, dirty faces, and greasy hands. Even if the morning ablutions have not been entirely neglected, the little ones may carry with them the germs of tuberculosis, scarlet fever, whooping cough, smallpox, or other diseases. The teachers' injunction not to wet the fingers in turning the leaves of books is universally disregarded.

At Montreuil, near Paris, a method of disinfecting schoolbcoks, which should almost entirely prevent the dissemination of disease, has recently been introduced; but before we describe this system, let us cite a few typical instances of the propagation of diseases by books and papers.

The following case was reported to the Academy of Medicine by Dr. Josias. A lady residing with her daughter in a Breton village, which was entirely free from scarlet fever, received a letter from the child's governess, who was then traveling in Germany. The governess wrote that she had had an attack of scarlet fever, but was now convalescent and had just entered the period of desquamation. A few days later, the mother and daughter contracted scarlet fever. The mother died, and the daughter barely escaped with her life.

Brouardel records the propagation of an epidemic of tuberculosis among the clerks of the archives of Kharkof (Russia). One of the clerks, who was in the second stage of tuberculosis, was in the habit of wetting his finger in his mouth in turning over the pages of the registers which he had to consult. French army surgeons have found disease germs in the records of numerous hospitals; and Dr. Knop, of New York, in his work on the "Tuberculous Infection of Books," cites the case of twenty clerks of the health department of Lansing, Mich., who became victims of tuberculosis as a result of handling books infected by one of their colleagues. It has been shown by numerous experiments that cultures of microbes spread on paper show a resistance which varies greatly with the species of microbes. The cholera vibrio becomes inert in 48 hours, the germ of diphtheria in 28 days, the bacillus of Eberth in 40 days, and Koch's bacillus in 130 days.

Various methods of disinfecting books have been invented. The most effective method would be the total destruction of the books, but this is too radical to be employed except in rare emergencies. In some English and Scotch cities, the public libraries receive daily, from the health bureaus, the names and addresses of all cases of infectious disease. If it is found that any books have circulated in infected houses, these books are disinfected or, in some cases, destroyed. This system is used in Bradford and Birkenhead. In London, where the density of population would greatly complicate the problem, no books are loaned.

In France, Dr. Lop proposed, several years ago, to disinfect the books of the primary schools every summer; also to disinfect the books, notebooks, and clothes of every pupil attacked by a contagious disease. But how can a book be disinfected without damaging it? Krauz recommends exposure to high-pressure steam for 40 minutes. The condition of the binding and the pages after such treatment may be left to the reader's imagination. The original process of Berlioz and Championnière does not seem much better. This process consists in subjecting the objects to the vapor of formic and ethylic aldehydes in an oven heated to about 200 deg. F. This treatment, continued for two hours, completely destroys the most virulent germs (tuberculosis, diphtheria, coli bacillus, etc.) placed on the edges, or even in the center of the volumes. For example, a large volume of 1,300 pages was selected for experiment. One of the middle pages was saturated with pus, and another was soiled with fecal matter. A portion of each of these pages was torn off for use as a control. The volume was then placed in the disinfecting oven, and heated for two hours and fifteen minutes to about 180 deg. F. Experiments in producing cultures with the soiled parts gave entirely negative results. Unfortunately, the treatment slightly injured both paper and binding. Marsoulan has recently improved this method by the invention of the simple apparatus which is now in use at Montreuil, in the workshops where diseased persons and cripples are employed. In the improved process, the books first go through the beater. This machine is a long box connected at one end to an ordinary stove, and provided at the other end with a door through which open racks containing the books are introduced. Inside the box wooden rods are caused to rise and fall, alternately, by cams placed on a cylinder which is turned by a crank. A ventilating fan and a sliding drawer complete this apparatus, which is mounted on trestles. When the crank is turned, the rods strike the covers of the books and dislodge the dust. The heavy dust falls into the drawer upon a mass of sawdust, saturated with a powerful disinfectant, while the lighter dust, carried off by the air current, is consumed in the stove. After this treatment, the books are suspended singly by pincers from a series of open metal racks, the covers of the book being bent back. Thus the pages are freely separated, and give easy access to the antiseptic vapor. These racks are mounted on rails, on which they are run into the disinfecting oven. Each of the three ovens employed at Montreuil accommodates two racks of books. The ovens are sheet-iron boxes, hermetically closed. Two sides of the box can be raised by cranks to admit the book racks. In the center of the oven is a vessel filled with a solution of formic aldehyde, into which

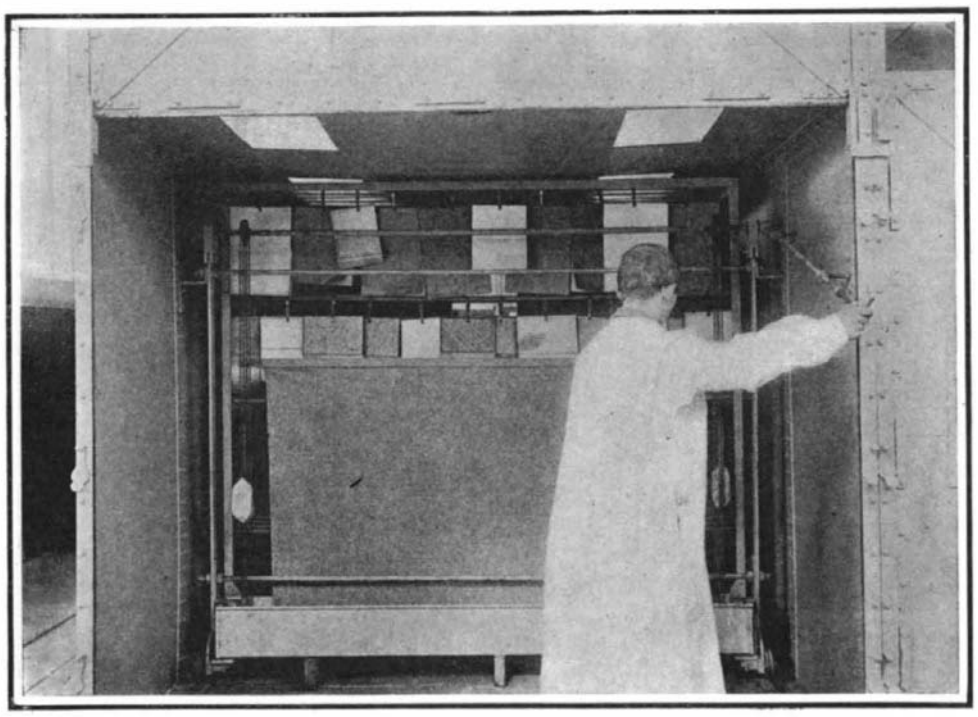

Fig. 4.—Agitating the felt saturated with formic aldehyde.

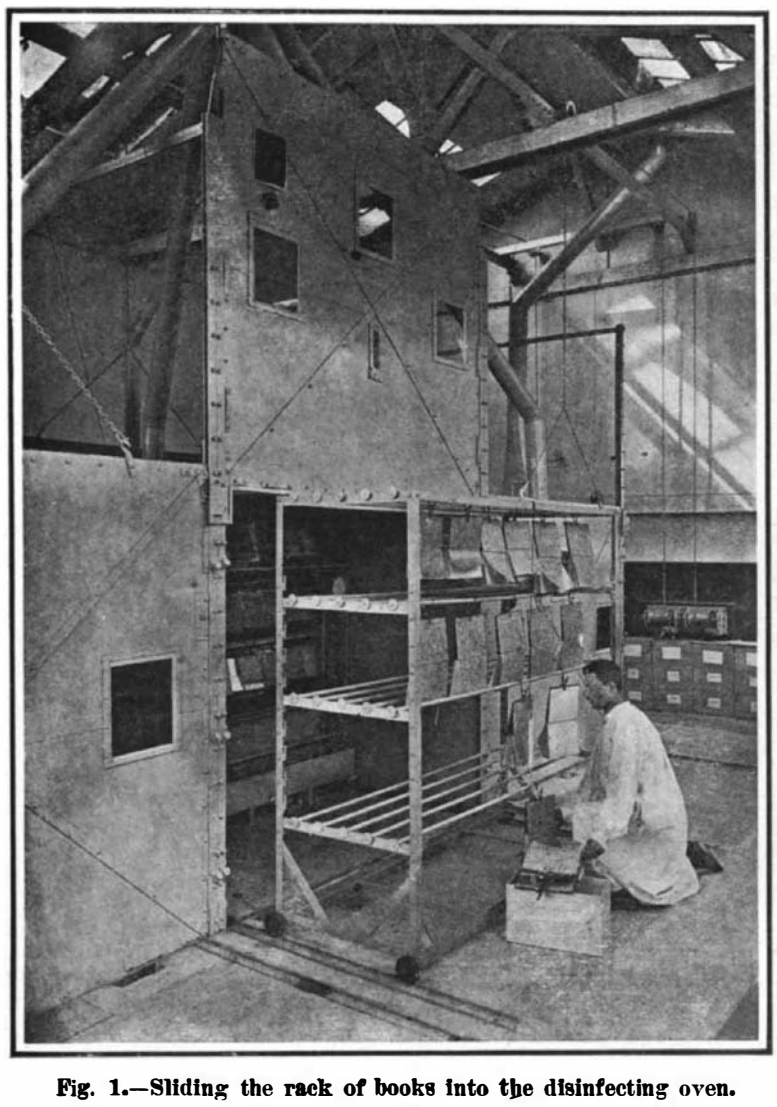

Fig. 1.—Sliding the rack of books into the disinfecting oven.

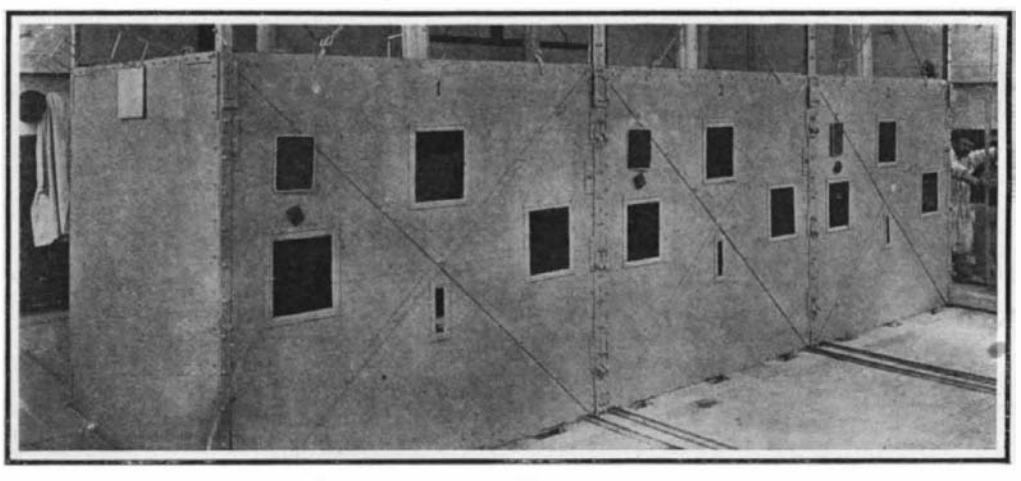

Fig. 2.—The disinfecting ovens.

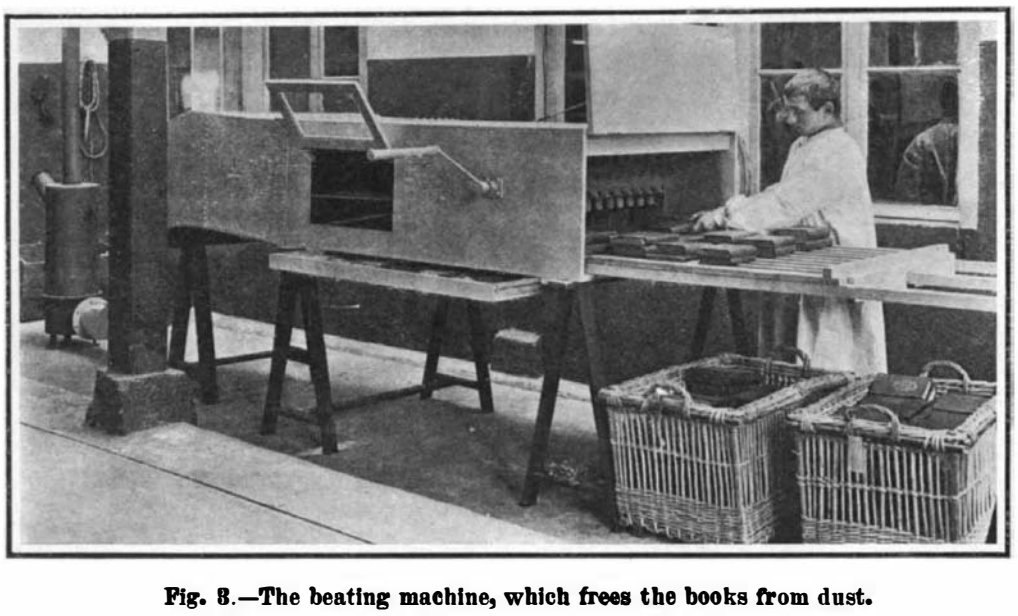

Fig. 3.—The beating machine, which frees the books from dust.

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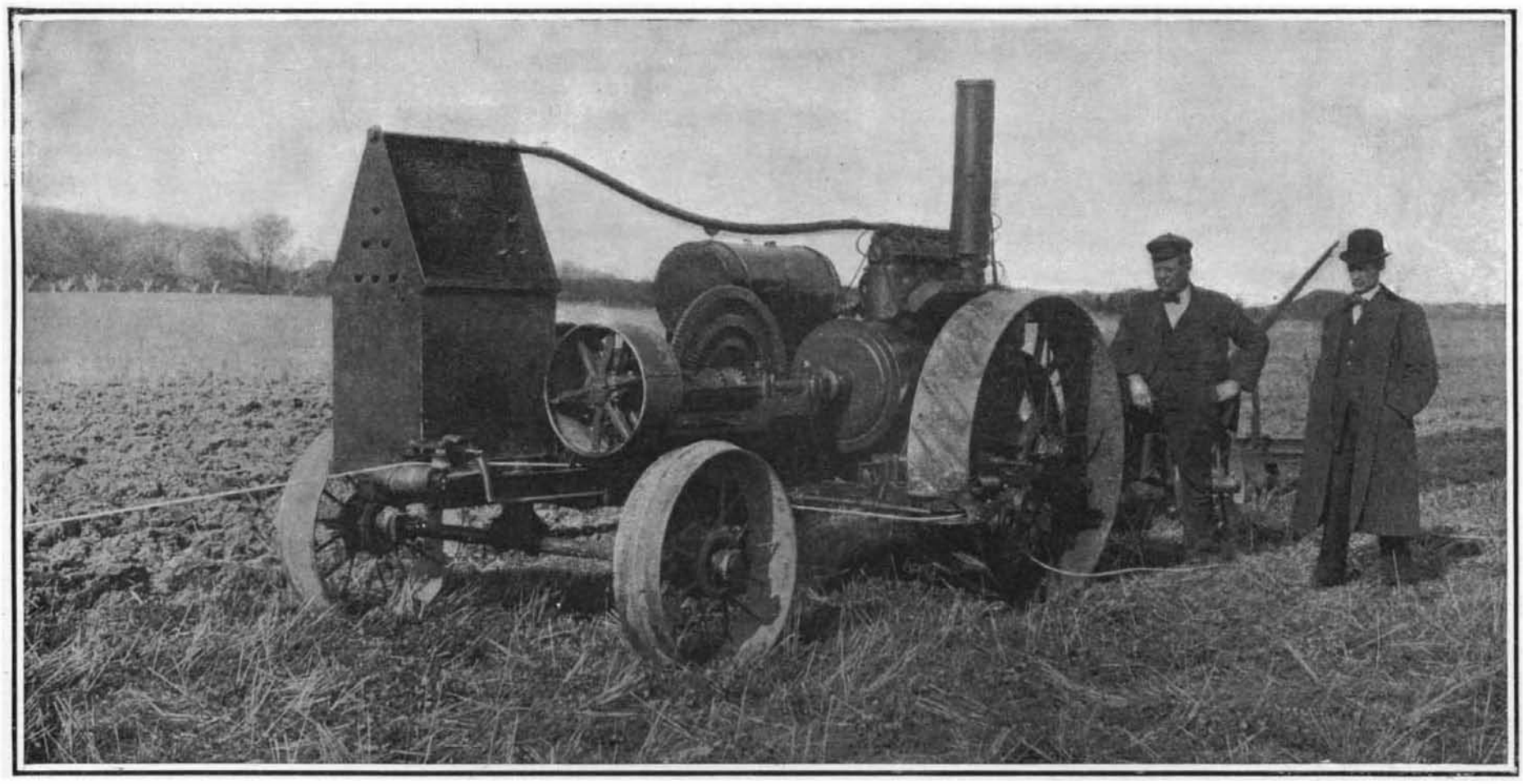
dips a strip of felt, which can be moved up and down from the outside of the oven. The ovens are heated, by steam pipes placed below them, to 122 deg. F. The irritating vapor of formic aldehyde makes its escape through a pipe at the top of each oven. The operation of disinfection is simple. The vessel is filled with formic aldehyde, and the racks laden with books are pushed into the ovens, which are then closed and heated to the required temperature for a few hours. After the heating is stopped, the volumes are allowed to remain in the ovens until the next day, when they are found to be entirely aseptic. This improved process of disinfection does not injure either paper or cardboard. It is very efficacious, as has been proved by the experiments of Dr. Miquel, and it is also very cheap, costing only about one-half cent per volume. The Municipal Council will shortly be asked to establish new disinfecting plants at various points around Paris, in order to extend the system to all the school libraries of the Department of the Seine. Several foreign cities are about to follow this example.

AN AMERICAN FARMOBILE.

BY FRANK C. PERKINS.

The accompanying illustration shows an American gasoline plow tractor in service. The machine is operated with a cable, but the plow is not drawn along wholly by traction. Two cable drums are provided, each having five grooves to fit the cable. The cable is coiled around the drums five times and then



AN AMERICAN FARMOBILE.

projects from the side of the machine. The harder the pull on the machine the tighter the grip of the cable on the drums. Still, there is no friction because the cable fits the groove, and because the traction wheels and the cable are geared together, so that all the tractive effort and the balance of the load fall on the cable.

When a soft spot is encountered or sand interferes the wheels will slip a little, and the cable will take up the load. In other words, the traction wheel is geared about 10 per cent faster than the cable drums, thus causing the traction wheels always to slip a little on the ground on a hard pull. In a field demonstration the cable clutch was thrown out and the machine started, but it could not move from its own tracks. It stood and dug a hole 15 or 18 inches deep. The cable was then thrown in by the clutch and the tractor moved on. The machine is capable of pulling ten plows at a weight of about 8,500 pounds.

When the tractor is run to the end of the field the cable is uncoupled at the front of the machine and the rear. The machine and plows are then turned around, and the front end of the machine is coupled to the cable.

In using the machine it is necessary to stake off a strip of land about 200 to 300 feet wide and to string a cross cable at both ends of the field with a single snatch block running upon it.

It is stated that in some instances as much as a mile of cable is used. By shifting the large bevel gear the pinion is disengaged, so that the machine may be used for threshing or general farm work.

The tractor has three speeds, 1½, 2½, and 3½ miles per hour. The 3½-mile speed is for traction on the road or the hauling of wagons or machinery across the farm.

A New Kind of Illuminating Gas.

What is known as the De Laitte system of lighting houses with gas has attracted not a little attention in Europe. Private electric light, coal, or kerosene gas plants, because of their very large initial cost, cannot always be installed. Since gasoline has come into fairly common use and is obtainable almost everywhere, a French inventor, M. Benoit de Laitte, has devised a method of generating gas from gasoline. When gasoline vapor is passed into pipes having a temperature lower than that at which the evaporation is accomplished, some of the gasoline will recondense into liquid form. Because the supply piping is underground and exposed to low temperature in winter, not a little trouble is thus caused. De Laitte has devised a carbureter which is intended completely to vaporize gasoline in very cold weather without the application of heat. In it the temperature of evaporation falls as low as —17 deg. Fahr., which is far below the lowest winter temperature in most civilized countries. For this reason condensation is practically impossible.

It has been found that air will absorb variable proportions of gasoline, depending upon the humidity of the atmosphere. To overcome this objection, De Laitte extracts all the moisture from the air, which is carefully kept from contact with water, and thus the air on carburetion is perfectly dry. Hence a uniform gas is produced without the possibility of variation.

The principle of the De Laitte process consists in the fact that a measured quantity of gasoline is converted into vapor by a measured quantity of air passed in a brisk current over a large surface of gasoline. The particular part of the apparatus in which this is accomplished is the carbureter. The current of air is produced by means of a drum, which induces a certain fixed quantity of air for each revolution, and this movement is obtained by a gear in such a manner that for every cubic foot of air taken up, a fixed amount of gasoline is induced into the carbureter. By this means a gas of unvarying quality is obtained, and perfect evaporation effected.

The carburetion takes place in a flat metal tube of considerable width and small depth. The gasoline flows downward, covering a large surface, over which the rapid current of air is conducted. The evaporation thus caused is so vigorous, that absolutely no residue is left when good gasoline is employed, even at a temperature many degrees below the freezing point. The proper gas is collected in a small gasometer, which serves to regulate the pressure, and which acts on the driving power of the drum in such a way that when no gas is required, the apparatus is stopped.

The motive power necessary to drive the apparatus is exceedingly small—a weight, water power, electricity, hot air, or a gas motor being employed. The gas is burned with incandescent mantles, but in consequence of the exceedingly high temperature and combustion, the illuminating power is considerably increased.

Between thirty and forty towns are lighted on this plan in Europe. In England there are about six thousand installations, which include hundreds of public buildings, railway stations, etc. About twenty or thirty plants are installed in India.

The Current Supplement.

The current SUPPLEMENT, No. 1751, opens with an interesting article by the English correspondent of the SCIENTIFIC AMERICAN on a new type of transporter for handling meat at Buenos Aires. The length of life of a motor boat and engine is so dependent upon proper care, that it will pay every owner of such a craft to understand thoroughly the vital points to be remembered, and to see to it personally that the boat and power plant are kept in good condition. Mr. Harold Whiting Slauson gives the necessary information in an article entitled "The Care and Operation of a Small Motor Boat." An automatic device for securing the profile of the ground, such as is needed for railroad work, is described by the Paris correspondent of the SCIENTIFIC AMERICAN. A graphic comparison of steam and gas engines as power producers is presented. James Ferguson's famous mechanical paradox is described—a device which consisted of three geared wheels that performed rather remarkable revolutions because the number of teeth in the three wheels were not the same. T. C. Bridges writes on Martyrs to Science. The future of the earth is discussed in an article by Abbé Moreux, in which he points out that our earth may be changing its shape. S. Leonard Bastin writes interestingly on the mimicry of plants. G. Devaulay contributes a most instructive article on the precision of astronomical observation. An apparatus for electrolytic refining of precious metals is described by H. La Croix. Dr. Max Dieckmann presents a partial solution of the problem of electrical vision at a distance. We have had occasion recently to mention in these columns a new musical instrument called the "choralcelo," which depended upon electrically-vibrated musical springs for the production of musical sounds. The particular apparatus employed is described in the current SUPPLEMENT.

The wheels of automobiles are usually inclined to the vertical, because the spindles on which they turn are slightly inclined to the rest of the axle. This practice of inclining the spindle originated in horse-drawn vehicles, in which the wheels are dished, that is to say, the spokes are arranged, not in a plane, but in a conical surface, with the apex inward, for the purpose of giving greater resistance to lateral shocks. With the dished wheel the inclination of the spindles is necessary, for the wheels of horse-drawn vehicles are high and their spokes long, and it is desirable that the spoke which for the moment is supporting the weight should be in a vertical position.

It may be doubted whether this argument applies to the small, compact, and stout wheels of automobiles. The constructors of the first automobiles regretted that the chains apparently made it impossible to incline the driving wheels. It was subsequently discovered that the chains did not form an obstacle, and hence the wheels are now inclined. It is questionable, however, whether this construction does not have the effect of giving the wheel a tendency to run in a circle, and of increasing the friction against the ground.