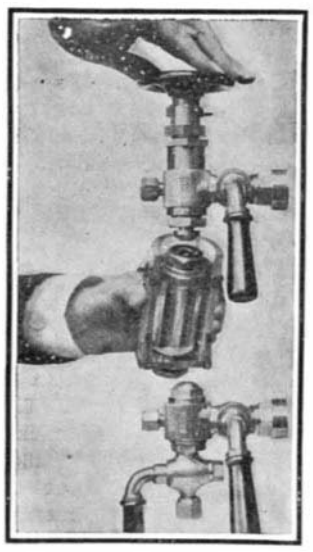
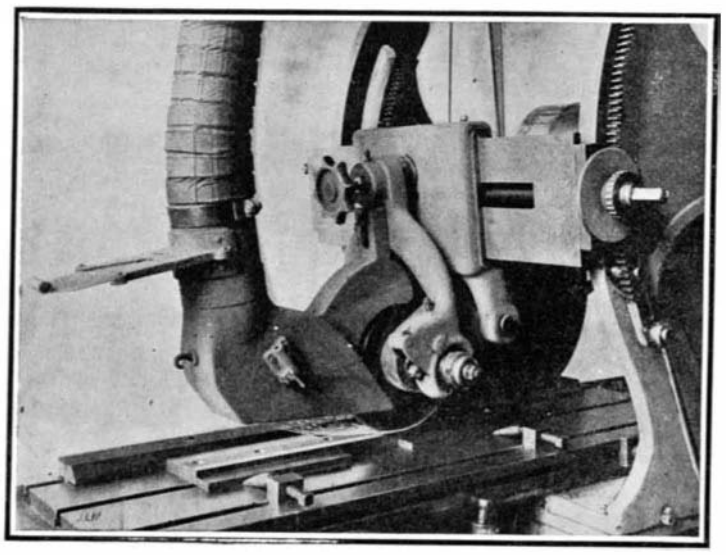
AN EXPOSITION OF SAFETY DEVICES AND INDUSTRIAL HYGIENE.

The general public realizes in a vague sort of way that nearly all industries are more or less dangerous to those engaged in them, and that a good many workers are killed or injured yearly in the pursuit of their vocations. Possibly it is better for the peace of mind of that curiously apathetic creature, the general public, that it is not more thoroughly familiar with the absolutely frightful cost of the "victories of peace." Every now and then the reports of the Interstate Commerce Commission upon the price of railroading in human life and safety arouse indignant press comment throughout the country. Unfortunately, the excitement soon passes away under the impetus and drive of our American life, and the whole matter is forgotten until—the next time. It is necessary for the welfare of the entire people that there should be an awakening and a recognition of the price in lives and suffering which we yearly pay for our industrial triumphs. The American Institute of Social Service has been actively engaged during the past few years in disseminating information concerning the terrible conditions obtaining, means for bettering these conditions, and data regarding the progress which has been made abroad in methods of industrial safeguarding. To further this propaganda, an Exposition of Safety Devices and Industrial Hygiene will be held at the American Museum of Natural History, New York city, from January 28 to February 9, under the auspices of the American Institute of Social Science.



A Device to Prevent the Scattering of Fragments from an Exploding Gage-Glass.

How imminently necessary it is to awaken the public conscience in this regard is shown by an array of figures compiled by the Institute, which are positively staggering in their fearful magnitude. For instance, it has been shown that there are some 80,000 more people accidentally killed in the United States in four years, than all who fell in battle and died of wounds on both sides during the four years of our civil war. In other words, in the same length of time 53 per cent more people are killed in industrial occupations than two great armies could destroy in a war of exceptional bloodiness. Every year we are killing over twofold more than perished by violence in both the French and English armies during the Crimean war. It has been demonstrated that there are nearly 3,500 fatal accidents in New York city every year. The census for 1900 shows that during that year there were reported 57,513 deaths by accident and violence in the United States, with an accompanying number of non-fatal casualties many times greater. Without increase of the annual rate reported by the government in 1900, there will be 575,000 persons killed every ten years, besides some 5,000,000 injured, even if the proportion of accidents to the population should prove to be no greater in this country than that of France. According to President Strong of the Institute, this would be equivalent to massacring every inhabitant in three cities the size of Indianapolis, Kansas City, and Denver every ten years, and at the same time maiming and mangling every man, woman, and child in Washington, Oregon, California, Nevada, Utah, New Mexico, Arizona, Colorado, Wyoming, Idaho, Montana, and Oklahoma, and doing it every ten years.

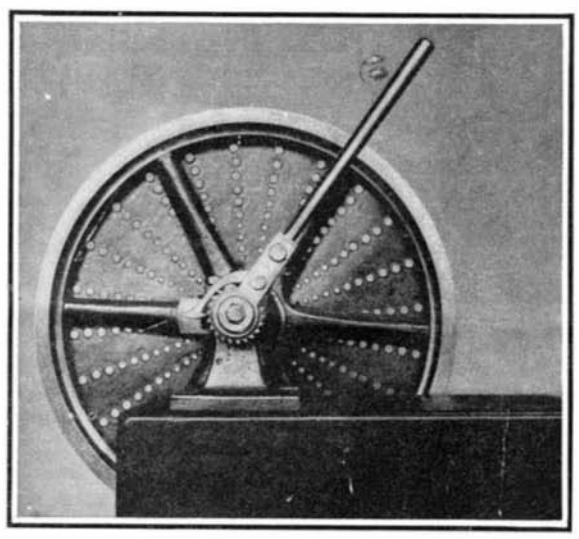


Dust-Absorbing Device for Surface-Grinding Machines.

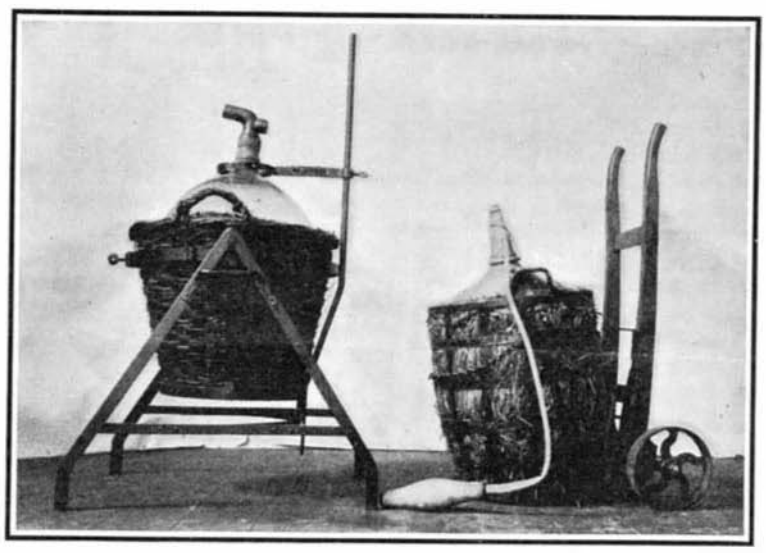
It would almost seem that the people of this country have either become reconciled to this terrible state of affairs, or are entirely ignorant thereof. It is undoubtedly true that many accidents cannot be foreseen, and are inevitable in spite of all possible precautions. Nevertheless, the work carried out by certain societies in Europe has shown that beyond question the greater portion of industrial accidents are preventable. We must not, however, imagine that accidents have been reduced to a minimum abroad. Statistics demonstrate that in Germany, a country remarkable for its thorough governmental supervision of industrial conditions, and painstaking care on the part of its employers to safeguard its workmen, of 15,970 accidents investigated, 53 per cent were avoidable. At that rate it is but fair to assume that in this country more than three-quarters of the accidents are preventable.

In most of the European countries social and industrial science of this character is far in advance of similar phases of human endeavor in the United States. There are numerous societies in France, Germany, Austria, Belgium, and Holland, devoting themselves solely to bettering the conditions under which the workman procures his livelihood. Among the best features of these associations are the permanent museums for exhibits of interest in this connection. Among these are the Paris Museum of Security, organized in 1905; the Berlin Museum of Security, organized in 1903; the Munich Museum of Security, organized in 1900; and the Amsterdam Museum of Security, organized in 1893. These societies carry out their purpose in the usual manner, by means of permanent and temporary expositions, regularly published bulletins and periodicals, and illustrated lectures.

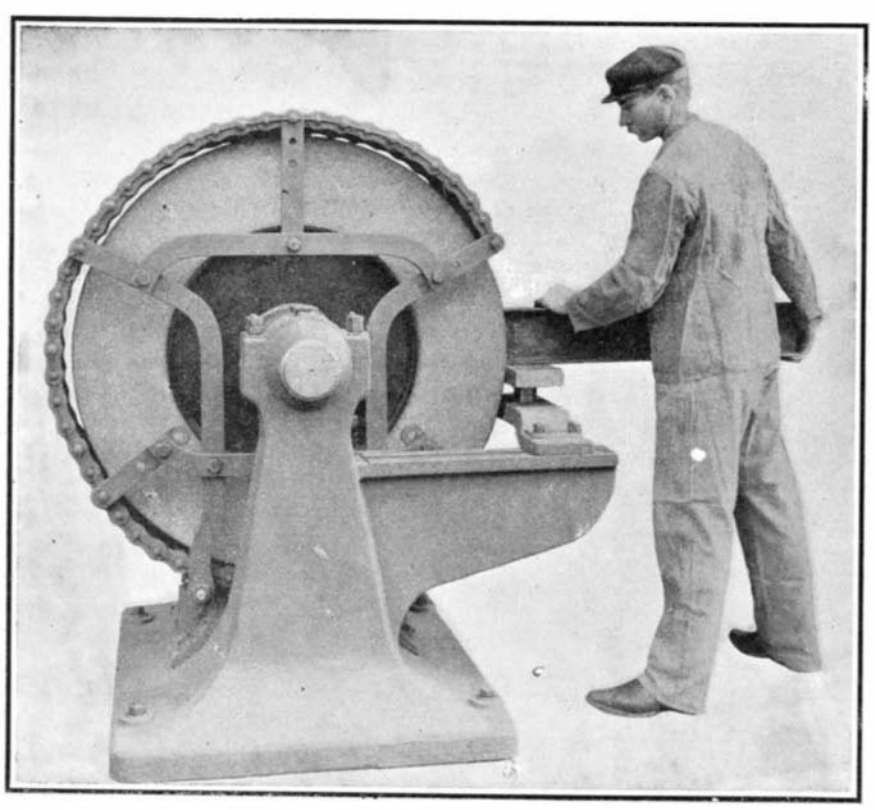
The attitude of so many of our manufacturers, who maintain that a man, foolish enough or careless enough



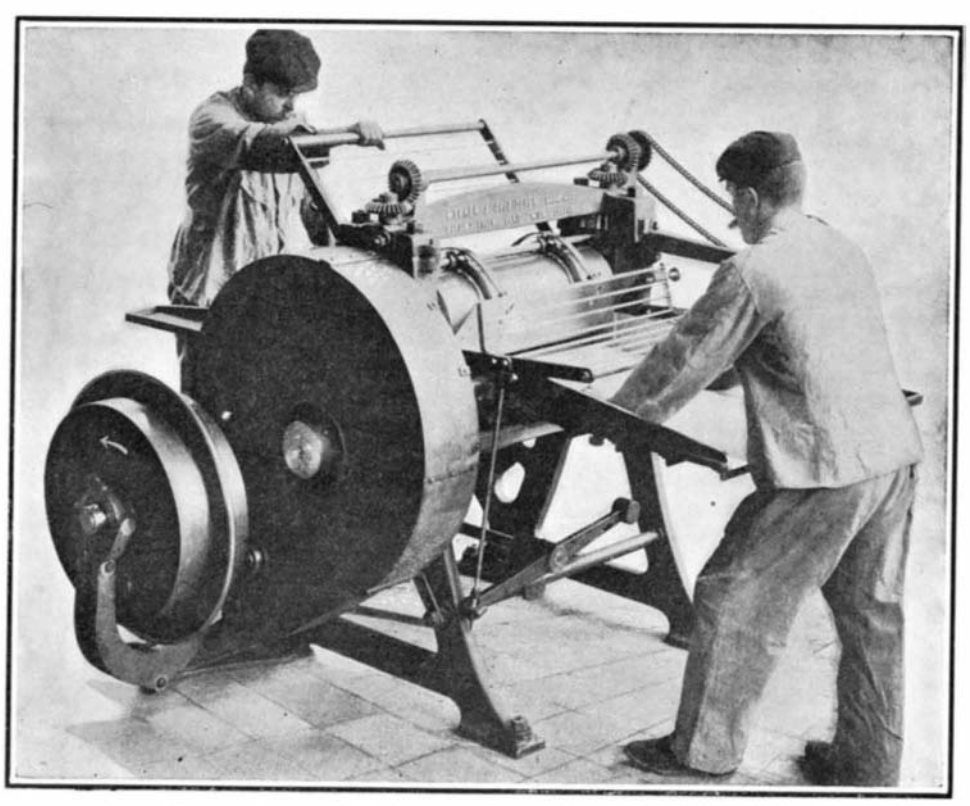
Device for Starting Gas Engines.



Guards and Holders for Acid Carboys.



Guard for a Heavy Grinding Machine. The Chain Prevents the Scattering of Fragments if the Stone Should Burst.



A Dough-Working Machine Provided with Device to Prevent the Fingers of the Operator from Being Crushed Between the Rolls.

to be injured in the pursuit of his vocation, deserves no sympathy and gets merely what he deserves, has been a great obstacle to the furtherance of industrial safeguarding of American workers. This attitude is more than shortsighted; it is almost negatively criminal. Human nature is not perfect, and the fact that we are human and are prone to ignorance or even carelessness and negligence, is but an argument in favor of making allowance for such very human weaknesses. Legally, it is considered the duty of the employer to furnish the employee with proper implements and a proper place to work. Should he fail to do so, he is liable for any resulting accident. And ethically, it is equally his duty to safeguard the worker from the results of his own failings, due to natural and human weaknesses. Until we learn in this country that human life and human security are of greater value than the material dollar, until we learn that it is *not* cheaper to fight damage suits than to incur initial expense in the prevention of industrial homicide, the seeds of progress in industrial security must fall largely on barren ground. Happily there are signs of a more general realization in the future of the terrible cost at which our commercial activity progresses. It is to be sincerely hoped that the forthcoming exhibition will arouse at least a tithe of the attention of which it is worthy, and that it will result in opening the eyes of some of our captains of industry to this terrible underlying phase of nearly all of our producing interests.

The accompanying engravings are indicative of the character of the propaganda as evidenced by the exhibition itself. The exhibits consist of devices for safeguarding the lives and limbs of workmen and preventing accidents under the ordinary conditions of life and labor to which the general public is exposed. Many different types of machines are shown in operation, in the form either of models or of actual devices. With these are shown the safeguards to be used in connection with the machines. The section of industrial hygiene includes improved dwellings, methods for the prevention of tuberculosis and other diseases resulting from dangerous occupations, respirators and devices for supplying and maintaining pure air for the man working under conditions where this is necessary, and examples of first aid to the injured.

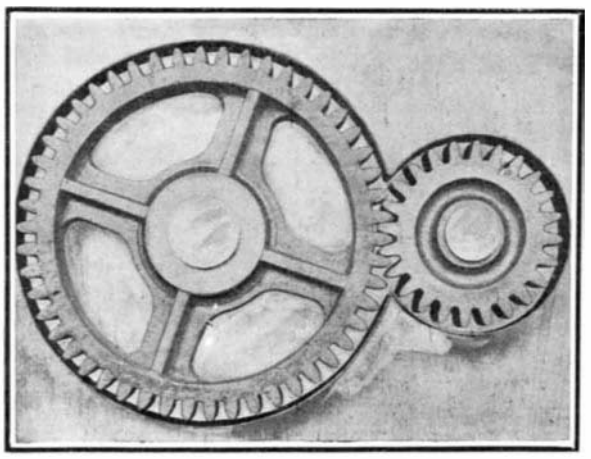
Among the safety devices exhibited are many ingenious and interesting constructions. They include a guard for large grinding machines, which is composed of a chain with large links through which is woven a long strip of steel. The chain embraces almost the entire circumference of the grindstone. The steel band stiffens the chain, which is mounted in place by lateral members of steel. If the grindstone should burst, it would be impossible for the fragments to fly off tangentially, and the lateral supports would prevent pieces from escaping at the sides. Another useful device illustrated herewith is a buzz-saw guard consisting of an adjustable frame which fits over the saw, and which is automatically displaced as the saw works its way into the wood which is being cut up. The wood itself gradually displaces the guard, and when the work is withdrawn, the guard returns to its normal position covering the entire saw. In many industries a dangerous feature is found in the ever-present dust, which is inhaled by the workmen and, in many cases, eventually leads to consumption and other diseases. One of the devices on exhibition is a dust-absorbing apparatus for a surface grinding machine. It comprises a box connected with a movable absorption pipe, through which an aspirator draws the dust. The box is mounted above the work close to the grinder.

Among the most unpleasant of the various accidents liable to occur in the shop is injury due to acids. The exhibition includes various guards and devices for sulphuric and other acid carboys. These devices prevent the breaking of the bottles, and permit of the easy decanting of the contents. Another safety device, which is of the greatest simplicity, but of the greatest importance, is the gear-wheel guard illustrated in another of the accompanying engravings. It consists merely of a metal band shaped to conform to the outline of the wheels, and mounted closely about their peripheries. This simple guard is very effective in preventing the workmen from coming into contact with the teeth of the moving gears.

Another device consists of adjustable gratings, which render it impossible for the operatives to have their hands injured by the rolls of a dough machine. The grating swings about the upper roll, and is so formed that the work can be slipped underneath it between the rolls, while at the same time it is impossible for the workman to pass his hand far enough under the grating to be liable to injury. The device is so constructed that the movement of the rolls is governed by the position of the grating, which thus serves not only as a guard, but also as a convenient means for governing the operation.

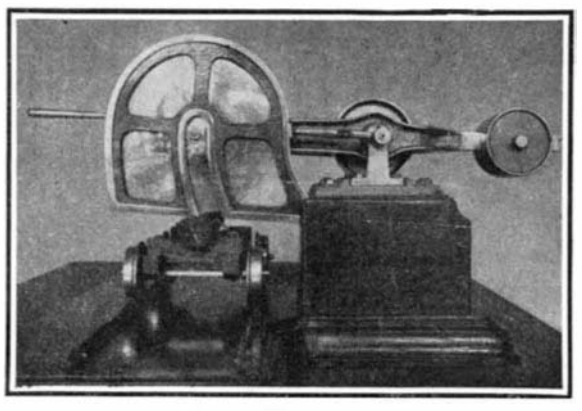
There is often an element of danger in the gage glasses used in connection with boilers, tanks, or other apparatus; for these glasses often burst under excessive pressure, and the flying fragments of glass thereby become projectiles which are dangerous, to say the least. One of the devices illustrated herewith is designed to prevent the hurling about of these glass fragments. It consists of a protecting casing of exceptionally strong glass mounted about the gage glass. A broken glass can be easily and expeditiously replaced with this device without interrupting the operation.

The object of this exposition is to direct the awakened public opinion to the necessity of active steps toward lessening the causes of accidents endangering the life and safety of the American workingman, and by means



Metal Guard for Gear Wheels.

of a permanent museum of security, where all problems of such safeguarding can be studied in working detail, to effect permanent industrial betterment.



An Automatically Lifting Buzz-Saw Guard.

AN EXPOSITION OF SAFETY DEVICES AND INDUSTRIAL HYGIENE.

Cold Galvanizing for Iron and Steel.

BY A. FREDERICK COLLINS.

Cold galvanizing or electro-zincing is an American process devised for giving iron and steel a protecting coat of zinc, and this is accomplished by electroplating the objects instead of dipping them into a molten bath.

Prior to the introduction of the new process it was necessary to melt up a large amount of zinc and to heat the iron and steel to be treated to a temperature equal to that of the molten zinc, when the objects were plunged into the latter metal.

The older process offers numerous disadvantages, and among the most important may be mentioned that the strength of the iron and steel thus coated is often considerably reduced and that screws and other threaded fittings usually have to be recut. Again, there is a considerable loss of zinc by oxidation due to the high temperature required, while the iron tanks are in time destroyed, due to the combination of the heated zinc with them, and finally the operator can not control the thickness of the deposits.

On the other hand, the one advantage the hot process has over the electrolytic or cold one is that the slower rate with which the zinc is electrolytically deposited makes the initial cost of the plant more than for the hot process, but, as Profs. Burgess and Hambuechen have pointed out, it should be borne in mind that the cost of one cubic foot of electroplating bath is only a small fraction of that of the hot galvanizing bath. That is, one cubic foot of zinc weighing 400 pounds, has a value of about twenty dollars, while one cubic foot of plating solution can be supplied for about 50 cents, and the anodes to furnish the zinc to the bath may be roughly stated to be from one to two dollars per cubic foot of solution.

The fact that zinc forms a good, cheap and durable coating for iron and steel made the wasteful hot process of galvanizing with all its disadvantages very profitable, and it is well known that zinc is far superior to tin or lead as a protecting medium, since it is electro-positive to iron and consequently it will be attacked before the iron when these metals are exposed to corrosion.

There are many valid reasons why the American electrolytic process of cold galvanizing, introduced by the Hanson & Van Winkle Company in this country, is better than the imported process of hot dipping; for instance, there is the all-important one of economy, since a large saving is effected in the metal; in many cases a deposit of one-tenth of the zinc used in the hot process will give better protection, owing to its uniform distribution as well as to the chemical purity of the zinc deposited.

In an electro-deposit of zinc the adhesion is perhaps even better than where the metal is applied hot and it is certainly more flexible, and if metal is in sheet form it can be more easily spun, or if in wire it can be twisted without the zinc coating splitting or cracking, while the temper of the most delicate spring can be maintained uninjured.

While dipping in the hot metal is the quickest when everything is in readiness, there is usually a saving of time by using the cold process, for it is always ready to operate and no time is lost, and an especially commendable feature of cold galvanizing is that it permits objects that are soldered to be coated. The work prior to being galvanized is cleaned as for nickel plating and other like operations when it is suspended in a tank, and almost all work can be given a protecting coat of zinc in from twenty to thirty minutes.

Zinc when it is deposited electrically is much more even and the coating more dense than can possibly be obtained by the hot dipping process.

Prof. Burgess has stated that the degree of protection offered by zinc is proportional to the thickness of the thinnest part of the coating, and therefore electro-galvanizing enables a greater protection to be obtained with a given amount of zinc than does the hot process, while the greater purity of electrolytic zinc, together with its greater density, gives it for equal thickness of coating an efficiency in resisting corrosion of 50 to 100 per cent greater than that of the hot process.

By using the electro-galvanizing process the thickness of the deposit may be controlled within comparatively wide limits, whereas with the hot process a very limited difference in thickness can be obtained and this only by increasing or decreasing the temperature of the molten zinc.

Where iron or steel objects that have lines engraved upon them, or have depressions cut into them are to be protected by galvanizing, if the hot process is used, the detail is lost by being filled in and the work must be gone over again, making it very expensive. Cold galvanizing acts diametrically opposite in that it does not fill up the depressions, however fine, but brings them out if anything more clearly.

As to the adhesive qualities of the deposits obtained by the opposed processes, there is probably little difference, though electro-metallurgical experts claim better results where cold galvanizing is used, but in either case the coating of zinc becomes closely allied with the iron or steel between the contact surfaces.

Cold galvanizing is now extensively used for zincing articles of steel, gray and malleable iron, ranging from screws and bolts to architectural iron. In addition sheet iron and steel, band steel, hoops, bicycle and automobile rims and spokes, telephone and telegraph fittings, and the like are being successfully treated.

A plant for electro-galvanizing comprises a low voltage compound wound dynamo, ammeter and voltmeter, connections, tank for solution, with fittings, solution or material for solution, cast anodes and a cleaning outfit for preparing work, all of which may be procured at small expense.

Superheater Trials on a Battleship.

The battleship "Britannia" is the first warship to be fitted with steam superheaters, and the analysis of the results of her trials is interesting, as it reflects light on the economy of the system. Six of the boilers in the "Britannia" had superheaters in the uptake, and as this number was equal to drive the engines at one-fifth of their power, it was decided to run two trials, each of thirty hours' duration, the one with ordinary steam and the other with the steam superheated to the extent of 90 deg. F. The result was to reduce the coal consumption by about 15 per cent, and to reduce also the temperature of the gases escaping from the funnel by 50 deg. In other words, with ordinary steam the coal consumption was 2.07 pounds per horse-power per hour, as compared with 1.77 pound while using superheated steam. Again, on the higher power trials the influence of the superheating of part of the steam had its effect as on the trial at 70 per cent of the power the coal consumption was 1.5 pound per I. H. P. per hour and at full power 1.83 pound. It is, however, at low powers that the gain is most wanted, as then the consumption is high owing to the auxiliary machinery taking such a large portion of the steam. Moreover, warships run for the greater part of their time at low power, so that if the gain of 15 per cent shown on trial can be maintained in service, the coal bill for the year will be appreciably lessened.—The Journal of Electricity, Power and Gas.