where a competent consular officer familiar with the languages and commercial uses of one foreign country is suddenly transferred to another, an evil under which Germany has long suffered.

The new German system will be a step farther on than any which has been taken by any other government, and the immense advantages of such a system are patent to all and the results will be immediate and lasting. The bureaucratic system of consular administration has been carried to its extreme limit by Germany, and now the government appears to have learned that the higher and more valuable work of the consuls requires special attainments and capabilities, not only in different countries, but even in different districts of the same country. Germany has set herself the task of remaining what she has become—one of the foremost manufacturing and exporting nations in the world. What she lacks in native materials and resources she will make up for by superior education, organization, energy and mastery of details, and in the furtherance of this policy every energy of the government and people, from the Emperor to the factory operative, will be enlisted and exerted with a persistent, unswerving patriotic purpose. The consular service is to be made, like her great subsidized steamship lines, the effective agent of the government for pushing the trade of German merchants into every corner of the civilized world; and our very efficient Consul-General at Berlin, the Hon. Frank H. Mason, considers that it will be organized, trained and equipped for this work with the same scientific thoroughness that characterizes the military, industrial and educational systems of Germany. As has already happened in law, medicine, engineering—in nearly every field of applied science—the day of the all-round man with a smattering of many things, but a thorough knowledge of nothing, is definitely past, and the success of the future will be won by the nations as well as by individuals who can bring the highest attainments, the largest experience, and the most consummate proficiency to bear where competition is keenest and the richest prizes are to be won.

PAWNBROKING.

A large part of a recent Bulletin of the Department of Labor is given to a report on pawnbroking in Europe and in the United States, by Dr. W. R. Patterson, of Iowa University. The facts obtained by Dr. Patterson are most interesting, although the precise origin of the pawnbroking business is still shrouded in obscurity. He is disposed to conclude that the banker of to-day is a descendant of the old pawnbroker rather than that the pawnbroker of to-day has derived his business from the ancient banker. In Holland the pawnbroking trade can be traced to 1534, when a pawn bank was set up by a Flemish priest at Ypres. Holland adopted a system in 1614, and France appears to have done so in the same year. It was not until 1591 that a pawn bank was established in Germany, although it is believed that an experiment was made as far back as 1198.

In the Continental countries generally, the government has undertaken the pawnbroking business for the benefit of the poor. This was doubtless in pursuance of the general governmental policy of suppressing the Jews, who had been for so many centuries the moneylenders of Europe and against whom charges of merciless usury and distraint had always been outstanding. This seems to account in some degree for the religious tinge given to the pawnbroking business wherever a Continental government has gone into it. The idea of saving the poor from oppressive interest-rates has caused some ventures to take the form of a gratuitous loan system; but as the theory has grown that the pawnbroking industry had a business side quite as important as its charitable side, and that its successful conduct and permanent usefulness depend upon its being on a self-supporting basis, the laws affecting it have been constantly liberalized to keep pace with the progress of the times. In Belgium, the interest varies from 4 to 16 per cent a year; in Holland, from 5 to 18 per cent; in Germany, the maximum rate is 2 per cent a month for sums of $7.50 or less and 1 per cent on all larger sums. In France the maximum rate was reduced to 6 per cent in 1887, with a fixed charge of one per cent on the sum loaned.

England, like the United States, has steered clear of governmental participation in the pawnbroking business. King Richard I. fixed the rate at 10 per cent in 1199; the Jewish brokers continued to charge from 45 to 65 per cent, so that they were expelled in 1290. The Lombards, who succeeded them, do not appear to have been much better and were driven out in 1530. Several sovereigns, including James I., Charles II., William III., and George I., tried various plans for regulating the trade. Laws have been finally framed which surround the trade with such restraints that the poor are protected.

In the United States the general tendency has been to leave pawnbroking as free as any other business, so that it does not become in any way an abettor of crime. Pawnbroking flourishes only in an urban district and in general in a rather congested locality. License fees and bonds are general, and the interest charges vary greatly in the different States. In Maine pawnbrokers can charge only 6 per cent a year on loans of $25 or more; while in one county of Virginia the interest may be as high as 10 per cent a month. In some of the States the sale of unredeemed pledges is required to be by public auction, and the laws which protect both the pawnbroker and his clients are legion. In Boston there is the greatest measure of police control. Pawnshops are in charge of some thirty detectives, five or six of them visiting each broker daily, and at least two-thirds of the robbers arrested in Boston were tracked by the pawnshops. There are laws in some States governing the articles which may be accepted in pawn, but usually the city ordinances adjust this matter. As a general thing it seems to be assumed that the pawnbrokers are quite an honest lot of men; even their patrons show a great deal of confidence in them, and where the population is settled, as in Philadelphia, it is not uncommon for regular pledgers to leave articles without taking any receipt, and in Providence the tickets are often left with the broker for safe keeping. Although the government does not go into pawnbroking in this country and every reasonable encouragement is given to pawnbrokers, there are a few privately capitalized corporations and societies having a benevolent aim in view, and the maintenance of them unquestionably acts as a check upon the rapacity of some of the brokers who are in the business for gain alone.

SAVING IN ISOLATED PLANTS.

BY ALTAN D. ADAMS.

Isolated electric plants are those devoted to the lighting of individual buildings, manufacturing plants, and institutions, as opposed to general public service. The electric machinery for isolated plants is usually located on the premises to be lighted, and driven from some previously existing source of power, or by an engine or water-wheel especially installed for the purpose. The cost of power per horse power hour delivered to the dynamo will vary with a variety of circumstances, but may be taken to range between 0·8 cent and 3·33 cents per horse power hour in nearly all cases.

Taking a suitable cost of power for any given case, the cost of electric light may be found when the charges for interest on first cost of electric equipment, its depreciation, the amount for lamp renewals and attendance are known. Basing estimates on the use of fifty-watt, sixteen candle power incandescent lamps, the following named prices are very nearly correct: First-class makes of dynamos may be had in medium and large sizes at about twenty dollars per kilowatt capacity, which amounts to one dollar per lamp capacity, since 1000÷50=20, which number of fifty-watt lamps can be operated per kilowatt of electric energy supplied. The cost of electric wiring and fittings is not quite so uniform as that of dynamos, but varies with the quality and style of fittings and the kind of building in which they are used.

In factory, warehouse, and other buildings where the electric wires may be erected in plain sight on porcelain supports, the average cost of all electric wires and fittings from the dynamos to but not including the lamps may be fairly taken at $2 per lamp. In office buildings and other places where the electric wires are drawn into iron or other conduits, the average cost of all electric wirings and fittings will be about $4 per lamp. Neither of above estimates is intended to cover the cost of the expensive brass fixtures sometimes used for electric lamps as well as gas, but the figures for open work include flexible electric cords for drop lamps, and the price for conduit work includes plain iron pipe fixtures for the support of lamps.

If ornamental fixtures are desired for the support of lamps, they may be had at a variety of prices, but their cost can hardly be included in the necessary cost of an electric plant. The engineer who has charge of the power plant usually gives the necessary attention to the electric equipment without additional compensation, but an average allowance of 0·01 cent per lamp hour may be made to cover extra services in all cases.

Depreciation and repairs, including the cost of oil and waste, may be safely taken at 10 per cent per year on the cost of dynamos, and an annual interest charge of 5 per cent should be made on the same cost. On cost of wiring, the repairs and depreciation will be covered by 5 per cent, and the interest by another 5 per cent per annum, making a total of 10 per cent. Incandescent lamps at the market price of twenty cents each, and burning four hundred hours on the average, which is hardly more than one-half the time they are frequently kept in use, cost 20 ÷ 400 = 0·05 cent per lamp hour. Taking as the average cost of one horse power per hour the mean of the maximum and minimum rates of 0·8 cent and 3 33 cents, above stated, the average rate becomes (0·8 + 3·33) ÷ 2 = 2·06 cents per horse power hour. Now, as one horse power is equivalent to 746 watts, it will operate 746 ÷ 50 = 14·92 fifty-watt lamps, so that the cost of power will be 2·06 ÷ 14·92 = 0·138 cent per lamp hour. Since, however, the average dynamo of medium size will only deliver as electric energy about nine-tenths of the mechanical power supplied to it, the actual cost of power per lamp hour will be 0·138 ÷ 0·9 = 0·153 cent.

The interest, depreciation, and repair charge on dynamos being 0·10 + 0·05 = 0·15, or 15 per cent per annum, and the first cost $1 per lamp capacity, these charges amount to 100 × 0·15 = 15 cents per year per lamp capacity; and on the basis of three thousand hours per year, or ten hours per day for three hundred days, the expense for interest, depreciation, and repairs is 15 ÷ 3000 = 0·005 cent per lamp hour.

On the exposed class of wiring at $2 per lamp, interest, depreciation, and repairs, at 10 per cent, amount to 200 × 0·1 = 20 cents per lamp capacity per year, or 20 ÷ 300 = 0·006 cent per lamp hour. In case of the wiring in conduits at $4 per lamp, the yearly charge is 400 × 0·1 = 40 cents per lamp capacity per year, or 40 ÷ 3000 = 0·012 cent per lamp hour. The total cost per lamp hour is the sum of above items, as follows:

Cost of power	0·153 cent per lamp hour.
Cost of lamp renewals	0·050 " " " "
Cost of attendance	0·010 " " " "
Interest, depreciation and repairs on dynamo	0·005 " " " "
Interest, depreciation and repairs on wiring	0·012 " " " "
Total cost to operate fifty-watt lamps	0·230 " " " "

This estimate for the cost of light in isolated electric plants is based on the most expensive style of wiring, and an ample allowance in other directions, so that it is probably higher than the actual cost in many cases, where cheaper power, less lamp renewals, no extra attendance charge, and less expensive wiring and fittings are had. It should be noted that nearly all the above charges occur only in operation of the plant, so that when not in operation the only charge is for interest and a small part of the depreciation named. To compare the cost per lamp hour of electric light from a public supply and from an isolated plant, the interest and depreciation, cost of wiring and fixtures may be omitted from both charges, as they would be the same for each, and the cost of lamps for public supply may be taken as included in the common charge of fifteen cents per thousand watt hour, as this is a usual practice, the supply station furnishing the lamps

At fifteen cents per thousand watt hour, the cost to operate a fifty-watt lamp is found from (15 × 50) ÷ 1,000 = 0·75 cent per lamp hour, while deducting the item for wiring in cost above found gives 0·230 — 0·012 = 0·218 cent per lamp hour as the cost with isolated plant. Dividing the cost per lamp hour with isolated plant by the cost from public supply gives 0·218 ÷ 0·75 = 0·29 or 29 per cent, showing the cost of light from the isolated plant to be only 29 per cent of the cost from public supply. Taking gas at $1 per thousand cubic feet, or one mill per foot, the cost for a 5 foot burner, corresponding to a sixteen-candle lamp, is 0·50 cent per hour, or 0·5 ÷ 0·23 = 2·17 times the cost of a sixteen-candle fifty-watt incandescent lamp in an isolated plant.

With the cost of electric light in isolated plants at less than one-third that from public supply, and not one-half that of gas, it is no wonder that the increase in the number of these plants has been one of the most marked features of electrical development during the past ten years; but the wonder is that in so many large buildings and institutions sums are still paid for lighting by gas or electric power that often in one year, and in very many cases two years, would cover the complete cost of a complete isolated plant. To prove this last fact, it is only necessary to remember that the cost of first-class electric machinery and wiring is only about $5 per lamp capacity, and then compare this figure with the yearly charge for gas or electricity from the public supply.

Assuming light to be required three thousand hours per year, the charge for electric power per lamp year at three-fourths cent per lamp hour is 0·75 × 3,000 = 2,250 cents, or twenty-two and one-half dollars; while with gas at one-half cent per lamp hour, the cost per lamp year is 0·5 × 3,000 = 1,500 cents, or fifteen dollars. If lamps burn so little as one thousand hours per year, or three and one-third hours each working day, the yearly outlay for gas is enough, and for electric power one and one-half the amount required for a complete electric equipment. This wide difference in cost between light from isolated plants and public supply is inherent in the circumstances of the two methods and cannot be overcome.

The cost of power to the public supply company is somewhat less, usually, than to an isolated plant, but these companies' fixed charges are enormously greater, and a large part of their capital must be invested in electric circuits between the central station and the consumer, on which there is a heavy charge for interest, depreciation, and repairs per lamp capacity. Isolated plants seem certain to prove in the future, as in the past, one of the most important fields for the application of electrical equipments.

THE shortage of pig iron has been causing some inconvenience, particularly in the West, where some founders have had to shut down, owing to the lack of raw material. It is not thought that the famine will last very long.

The Large Countries of the Globe and Their Colonies.

M. Paul Barré, secretary of the Société de Propagande Colonial, says L'Illustration, has compiled a list of the colonial possessions of the various powers. Following are the figures which he gives:

	Million Inhabitants.
British Empire	406
Chinese Empire	400
Russian Empire	132·5
France and colonies	97·5
United States and colonies	85·5
England and colonies	61·5
Japan	45
Austria-Hungary	44·5
Holland and colonies	33
Ottoman Empire	25·5
Belgium and the Congo State	23·5
Spain and colonies	18
Brazil	17
Portugal and colonies	13·3
Mexico	11·5

Of the inhabitants of the British Empire, about 40,405,000 are in Europe, 308,300,000 in Asia, 45,000,000 in Africa (including Egypt), 7,100,000 in America, and 5,500,000 in Oceanica.

France has 38,300,000 in Europe, 23,600,000 in Asia, 35,000,000 in Africa, 420,000 in America, and 150,000 in Oceanica.

The following table gives the land area of the countries having about a million or more square miles of surface:

	Square miles.
British Empire	11,969,720
Russian Empire	8,803,536
Chinese Empire	4.324.544
United States and possessions	3.794,015
Brazil	3,228,735
Germany and colonies	1.235,584
Ottoman Empire	1,154,112
Argentine Republic	1.077,274
Portugal and colonies	911,243
Belgium and Congo State	899,273
Holland and colonies	751,775
Mexico	747,914
Persia	635,167
Bolivia	511,222
Colombia	464,502
Peru	438,817
Venezuela	403,109
Spain and colonies	391,139

England occupies the first place in respect to her population and area. She contains a quarter of the human race. A second quarter is Chinese. Almost a third quarter is contained in Russia, France, United States, and Germany. Three-quarters of the population of the globe are therefore governed by only six states.

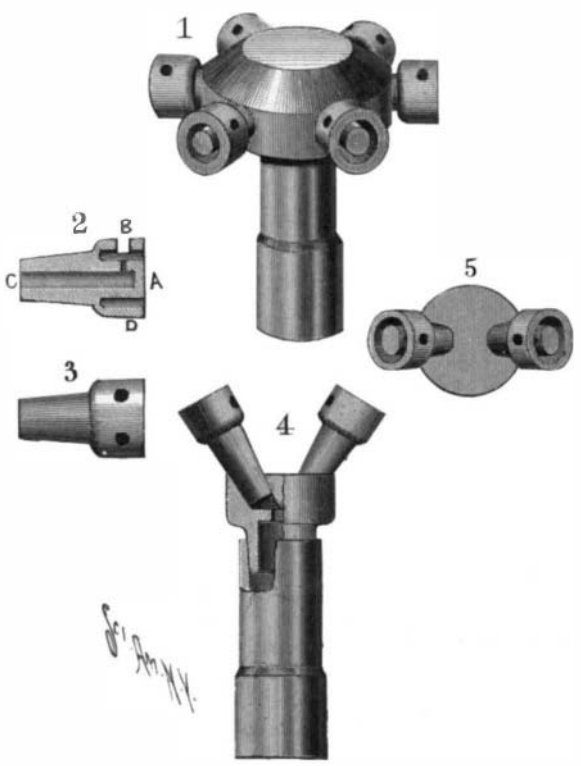
The Anglo-Indian empire contains only 125,489 square miles in Europe, but it has 2,248,476 in Asia, 2,625,616 in Africa, 3,665,823 in America, and 3,299,781 in Oceanica.

France has 206,960 square miles in Europe, 309,668 in Asia, 3,706,752 in Africa (including the zone of French influence), 78,382 in America, and 15,058 in Oceanica.

A NEW ACETYLENE GAS BURNER.

Acetylene gas possesses so many advantages for isolated lighting that it is little wonder the industry is constantly progressing and is now on a sure foundation. One source of trouble which consumers have had with the new illuminant has been that owing to the great richness of the gas it was not possible to provide burners which would consume more than one cubic foot of acetylene gas per hour without smoking and consequent loss of luminosity. This difficulty has been obviated in a new acetylene burner invented by D. M. Steward, of Chattanooga, Tenn., by the grouping of any number of flames on one-burner and by a new air-mixing device. Our engraving shows the construction of the burner. The pillar does not differ from those in general use. At the upper end of this pillar is fitted the head of the burner proper which is made of lava or other similar substance. The burner stems extend from this head and diverge from each other. They are arranged in pairs, and the jet openings in each stem are adapted to direct the jet toward that of the adjacent stem. Each stem is of cylindrical form, and is made slightly tapering with the smaller end fitting into the openings in the head and its larger end surmounted by a burner tip formed by an annular cup-shaped flange, *D*, and extension, *A*, in which the discharge opening is drilled. An opening, *B*, is drilled through the flange opposite the opening from the tube proper, *C*, which conveys the gas to the tip (see Fig. 2). Opening, *B*, in the flange is of larger diameter than that in the center wall of the burner. This flange provides an air space between the extension, *A*, which terminates the end of the gas tube, *C*, and the interior of the flange, so that as the gas is discharged from the opening it will suck the air into the air space, and so provide for uniform admixture of the air with the gas discharged through the aperture in the flange. The air-mixing device is a unique feature of the burner, and is an improvement on all previous burners, the old method being to surround the jet of gas with a number of small inlets or holes for air. In the new burner the cup-shaped cavity provides a sufficient amount of air, and keeps the burner cooler than with any other known construction.

The tips are so arranged that the two jets are directed toward the jet from the adjacent tip, and inwardly in an oblique position. The jets so discharged from each tip commingle with the jets discharged from the adjacent tip on each side so as to form flat flames The head being located between the pillar and



A NEW ACETYLENE GAS BURNER.

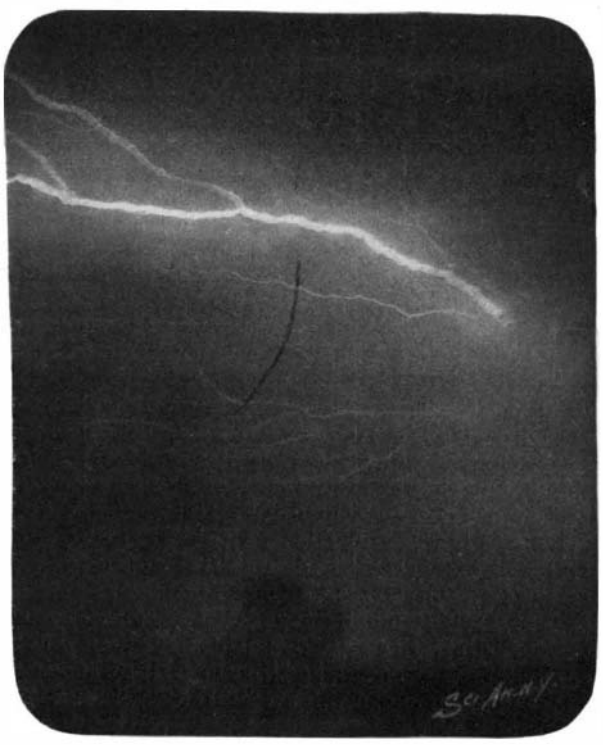
the burner stems, the pillar is kept from becoming heated. The burners are made by the State Line Talc Company, Chattanooga, Tenn.

PECULIAR LIGHTNING FLASHES.

Our illustration is taken from a photograph by Mr. A. E. Small, of Madison, Wis., made in June, 1898, and was sent to us by Mr. Robert M. Long, of Sun Prairie, Wis.

Attention is called to the peculiar ribbon-like appearance of the flash.

An experienced photographer of lightning flashes informs us that this photograph is an excellent example of its kind, and states that the theory is that the lightning, in its passage through the air, is driven by the wind so as to flatten it out, giving it the ribbon effect. This may occur oftener than we are aware of, because if the wind was driving the lightning toward or from the camera, the effect could not be observed. If, however, the wind blows across the field of view,



RIBBON LIGHTNING.

then an opportunity is afforded for getting a picture of this curious kind of a flash.

The tree barely visible at the bottom of the picture shows the flash to have moved in a horizontal direction across the sky.

It is probable the study of photographs of lightning flashes may become as interesting as those on the subject of astronomy. Certainly some remarkable effects can be obtained if the proper advance arrangements are made.

Automobile News.

There will be a parade of automobiles at Newport some time during the present month.

The first automobile club of Germany has just been organized and the Duke of Ratibor is the president.

The United States Express Company will soon have an automobile express wagon for trial in New York city. Horseless vehicles are an ideal means of transporting express matter in large cities.

A show of automobiles is to be held at Dover, England, September 18 to 21, simultaneously with the meeting of the British Association. The object of the show is primarily to provide an interesting display and to benefit the motor car industry.

A New Jersey automobile syndicate has recently increased its capital stock to a considerable amount in order to establish a connecting system between New York and Philadelphia. It is expected that this will be a model working system for other cities.

A recent writer in a New York paper has noted the fact that with the general introduction of automobiles cruelty to animals will almost cease. A driver will no longer be able to exercise his whip, and if he forces his motor unduly he is reasonably certain of a good repair bill.

A plan is on foot to establish an automobile line between New York and Morristown, N. J. The residents of that town object to a trolley line which it is proposed to construct, and it is possible that the traction company will start an automobile line, which will be unobjectionable.

Prince Lobenguela, of Matabeleland, recently had a ride in a horseless carriage. When the vehicle arrived, he inquired after the horses, and first considered it as a "devil machine." Finally he consented to mount and thoroughly enjoyed the ride. At the end of the trip he patted the automobile as though it were a horse.

On July 30, two automobiles beat the Paris-St. Malo express in a race between these cities, which are 226 miles apart, making the best time ever recorded for an automobile. They covered the distance in seven hours and thirty-five minutes. The time of the train was seven hours and forty-eight minutes. It cannot be considered a very fast express train, however.

As already noted, the number of accidents to automobilists in France is constantly increasing, and unfortunately a large number of them cannot be traced to any well-defined cause. The entire motor carriage seems to fail at the wrong time, when going at a high rate of speed. In most instances the carriage has been entirely destroyed and the occupants have only escaped death or serious injury by a mere chance.

The recent automobile exhibition at Paris more than paid expenses, and there is a tidy little balance left to facilitate international contests. The exhibition showed that what was desired by a large number of people was an automobile carriage which should be bigger than a tricycle and which could be sold at a price much less than the large and heavy automobile vehicles. Those which cost about $800 are very popular.

The Automobile, a monthly magazine devoted to the interests of horseless traction, will soon be published in New York city. The business manager of the magazine has just returned from Paris after a close study there during the last two years of everything appertaining to automobile carriage interests, and he has secured the co-operation of competent, expert writers in Europe. The first number of this periodical will be looked for with interest.

Liverpool has had an exhibition of horseless vehicles for heavy traffic. A number of lorries and heavily loaded wagons were set at difficult tasks, even to climbing zigzag gradients and running up hills laid with smooth cobbles. A Bailey & Thornycroft lorrie loaded, stopped and started on a steep gradient. It succeeded in successfully carrying its load of three and a half tons and restarted without skidding. It is the opinion of English experts that if England has been backward as regards motor carriages for pleasure, she is well ahead with vehicles for carrying freight, and that these wagons are destined to play an important part in the transport work for the army.

The automobile and bicycle exhibit at the Paris Exposition will be located in the building, at the Bois de Vincennes, provided for the housing of the railway exhibits of all countries. Ample space has been secured for the American bicycle building. It is located in conjunction with a special bicycle track for showing the wheels in operation. It is evidently expected that American builders will make a larger showing than any other country. A track two miles in length runs around the lake in the park, which will aid in properly showing the automobiles. A space of 4,300 square feet in the automobile building has been secured for American exhibitors. American builders of horseless vehicles are now so numerous and the types which they make are so varied that the display ought to be one which will be highly creditable to this new industry.