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THE UNIVERSITY OF MISSOURI BULLETIN

ENGINEERING EXPERIMENT STATION SERIES
VOLUME 1 NUMBER 1

ACETYLENE FOR LIGHTING COUNTRY HOMES

BY

J. D. Bowles.

UNIVERSITY OF MISSOURI
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The Engineering Experiment Station of the University of Missouri was established by order of the Board of Curators July 1st, 1909.

The object of the Station is to be of service to the people of the State of Missouri.

First: By investigating such problems in Engineering lines as appear to be of the most direct and immedate benefit and publishing these studies and information in the form of bulletins.

Second: By research of importance to the manufacturing and industrial interests of the State and to Engineers.

The staff of the Station consists at present of a Director and two research assistants together with a number of teachers who have voluntarily undertaken research under the direction of the Station.

Suggestions as to problems to be investigated, and inquiries will be welcomed.

Any resident of the State may on request obtain bulletins as issued or if particularly interested, may be placed on the regular mailing list. Address the Engineering Experiment Station, University of Missouri, Columbia, Missouri.

ACETYLENE FOR LIGHTING COUNTRY HOMES.

The farm home may be readily equipped in these days with every modern convenience. One of the most important of these conveniencies is a good lighting system. The oil lamp with its accompanying dirt, inconvenience, and danger, may be replaced, with the outlay of a few hundred dollars, by a lighting system almost equal in convenience and economy to a city lighting service.

Private Lighting Systems are divided into three classes: Acetylene, Gasolene, and Electric. This bulletin is the first of a series devoted to these systems; the others, Gasolene Lighting Systems and Small Private Electric Installations are in preparation.

Those who are interested may make their own comparison of these systems as to relative economy, convenience and practicability, when the series has been published.

This bulletin contains a brief discussion of the properties of Acetylene and of the Calcium Carbide from which it is derived when the carbide is brought into contact with water. The details of Acetylene Generation and of Acetylene Generators are studied, as well as the planning of a typical lighting arrangement in which are taken up in detail the factors governing the size and number of burners, the capacity of generator required, piping and fixtures, and the value of scientific shading and diffusing of the light where satisfactory illumination is desired. Cooking and heating by Acetylene is discussed briefly. The Design of a complete Installation is worked out in detail giving cost data. Village and Town Lighting Systems are briefly discussed. The appendix contains the results of tests made by the Station, a schedule of pipe sizes, and a table of dimensions and costs of Acetylene Generators, together with the list of Generators approved by the National Board of Fire Underwriters.

Useful information and data were obtained from the Acetylene Journal (Chicago) and Professor George Gilbert Pond's bulletin on Calcium Carbide and Acetylene published by the Pennsylvania State College.

The tests described were made with a 35 light Carbide Feed Generator furnished by the Eagle Generator Company of St. Louis.

The writer is indebted to Mr. K. A. McVey of the Experiment Station Corps for assistance in making the tests.

CALCIUM CARBIDE.

Calcium Carbide is the substance from which Acetylene gas is produced. It was first prepared on a promising commercial scale in 1892 by Thomas L. Wilson, a young electrical engineer at Spray, North Carolina. Wilson utilized the intense heat of the electric furnace, operating on a mixture of lime and coal tar. His search was for something of an entirely different nature and the discovery of Calcium Carbide and its remarkable property of producing Acetylene gas when in contact with water was purely by chance.

The Commercial Carbide is now prepared by incorporating a mixture of ground coke and lime in the proportion of 41.7 per cent and 58.3 per cent, respectively, and introducing the mass into an electric furnace where the intense heat causes chemical reactions to take place yielding 69.7 per

cent of calcium carbide and the remaining 30.3 per cent as carbon monoxide which is burned at the mouth of the furnace.

Calcium Carbide is a dark gray substance more or less crystalline in structure and very hard and brittle. A cubic foot of crushed carbide weighs about 136 pounds. It may be heated to redness or higher without suffering any change. It is not affected by shock or concussion and may be preserved indefinitely when kept in air tight cans or drums. In open air gradual disintegrations occurs due to atmospheric moisture.

Calcium Carbide is not affected by the ordinary solvents but when brought in contact with water vigorous decomposition ensues with the evolution of Acetylene gas and a residue of pure slaked lime. The gas and lime are formed in the proportions of 26 and 74 respectively by weight. A pound of chemically pure carbide would yield 5½ cubic feet of gas. The commercial carbide yields from 4¼ to 5¼ cubic feet of gas per pound. One pound of pure carbide would require .562 pounds of water for complete decomposition.

Calcium Carbide is packed in non-returnable sheet steel drums, containing 100 pounds each. The sizes of carbide regularly carried in stock are as follows:

"Lumps"—3½ inches by 2 inches. Large pieces.
"Egg"—2 inches by ½ inch. Medium pieces.
"Nut"—1¼ inches by ⅜ inch. For Carbide Feed Generators.
"Quarter"—¼ inch by one twelth inch. For Carbide Feed Generators.

The carbide industry of this country is practically monopolized by the Union Carbide Sales Company of New York and Chicago. It is distributed by various depots over the country. The nearest depots for this state are at Kansas City, Mo., and East St. Louis, Ill. The current price of carbide at these depots is $3.75 per 100 pounds in less than ton lots and $70.00 per ton in ton lots.

The railroad companies accord calcium carbide third rate classification and carry it along with other frieght.

ACETYLENE.

Acetylene is a colorless, tastless gas having a characteristic pungent odor. It is one of the so-called hydrocarbons, having a composition of 92.3 per cent carbon and 7.7 per cent hydrogen. This gas is lighter than air, its comparative density being about .92. The corresponding figure for ordinary coal gas is .45.

Acetylene will not ignite of its own accord, but when set fire to in open air it burns with a white flame yielding carbon dioxide and water vapor. The high density and percentage of carbon in this gas is the source of its wonderful luminosity. When burned from a suitable burner which premixes the gas with a proper amount of air, an intensely brilliant white light results, the spectrum of which approaches very near that of sunlight itself. No smoke or odor is perceptible. This light on account of its whiteness is of great value for accurately distinguishing colors and is very desirable for domestic purposes, being when properly shaded, very easy on the eyes.

The combustion of Acetylene deprives the surrounding air of 2½ cubic feet of oxygen for every cubic foot of the gas burned, giving off in turn 2 cubic feet of carbon dioxide and 1 cubic foot of water vapor. For pur-

poses of comparison we note that 1 cubic foot of coal gas requires 1 cubic foot of oxygen and throws off ¾ cubic foot of carbon dioxide. Now the ½ foot Acetylene burner giving 25 candle power consumes ½ cubic foot of gas per hour. The ordinary open coal gas burner giving from 18 to 25 candle power consumes 5 cubic feet of gas per hour. Thus we see that for equal illumination Acetylene impoverishes and pollutes the air only about one-fourth as much as coal gas. Now a coal oil lamp of the best kind will give about 25 candle power and consumes approximately one gallon of coal oil for twenty hours use. The oil lamp impoverishes and pollutes the surrounding air to a far greater extent than either of the above gases.

For equal candle power illumination Acetylene causes less heating of the surrounding air than coal gas and far less than the coal oil lamp.

Acetylene is considerably less poisonous than the coal gas which is ordinarily used for illumination. Fatal results from inhalation are not on record and it is said they could not possibly occur until the gas exists in the proportion of more than 20 per cent. The danger to be apprehended from this source is too remote for serious consideration. The steady escape of gas from an open half foot burner in an air-tight room 8 feet square and 8 feet high would produce a mixture of 5 per cent in 50 hours. The characteristic odor of the gas will attract attention to an open burner or a leak long before harm could result from same.

Contrary to the general concensus of opinion which seems to prevail, Acetylene is not a dangerous illuminant. However, this gas possesses in common with other illuminating gases the property of forming a violent explosive mixture with air. The ideal mixture would be one foot of gas to about 12½ feet of air. From this condition the mixture explodes with varying degrees of violence between the limits of 20 per cent of air to 4 per cent of air. Here again the odor of the gas would be liable to attract attention to the vicinity of a leak or open burner long before a dangerous mixture could exist in a room.

It is impossible to obtain explosion or even ignition of a body of pure gas by the introduction therein of a lighted match or electric spark. However, Acetylene may be exploded by the detonation of a dynamite cap or other violent explosive in a body of the pure gas.

LIQUID ACETYLENE.

At a temperature of 68 degrees Fahrenheit and about 597 pounds per square inch pressure, Acetylene may be liquified. This liquid is of a violent explosive nature and does away with all thought of storing the gas by this means.

No one has ever succeeded in getting an explosion from Acetylene at a pressure under one atmosphere. Since the ordinary pressure of the gas under service is but a few ounces at most, it is evident that there is absolutely no danger to be apprehended from this source.

DISSOLVED ACETYLENE.

When Acetylene is compressed and forced into a tank filled with some porous material saturated with the liquid "Acetone," it seems to lose the explosive properties that it ordinarily possesses when under pressure. Acetone dissolves twenty-four times its own bulk of the gas at ordinary temperature and pressure and the quantity dissolved increases directly with the

pressure applied. Now as the pressure is released the gas escapes and is delivered cool and dry to the burners.

Dissolved Acetylene finds its application with yachts, motor cars, railway headlights and railway car lighting. For ordinary house lighting it is entirely out of the question; acetylene can be provided for stationary purposes by generators so much more economically that Dissolved Acetylene finds no application here.

Acetylene is soluble in water to the extent of eleven volumes of gas to ten of water. But the solubility of gas in water is too limited to be put to any practical use. However it is of consequence for us to know about this, for the excessive use of water in a gas generating apparatus might cause considerable loss of gas.

ACETYLENE GENERATORS.

The function of an Acetylene generator is a comparatively simple one. It provides for the bringing together of the water and the carbide, washing and filtering the gas, storing it to a certain extent, and delivering it under a small pressure to the service pipe for distribution. Acetylene generators are divided into two general classes, Automatic and Non-Automatic. In the automatic machine the gas is generated as it is used, the quantity generated being automatically governed by the rate of consumption. In the non-automatic machine a definite quantity of gas is generated at a fixed rate and stored. The former type is used for all small installations such as house lighting plants. The latter type is used for large plants, such as village lighting systems. In this discussion we are interested chiefly in the automatic generator as a private lighting plant for the country home.

The most impotrant feature to be considered in the design of an acetylene generator is that of cool generation. When the carbide and water unite to form gas, violent chemical action occurs with the liberation of large quantities of heat. If this heat be localized, dangerous temperature rise is liable to occur. The carbide in such a type of generator would not give its full quota of gas and the burners would soon clog up due to its impure quality.

When water is fed into the carbide it is evident that there will be more or less localization of heat with consequent hot generation. Hence the most rational method would be to feed carbide in small well regulated quantities into a large body of water where the heat would be quickly transferred and dissipated. The water to carbide feed type of generator designated as the "water feed" generator is rapidly disappearing from the market and the carbide to water or "carbide feed" generator is now almost universally used.

The carbide feed generators are divided into the following classes by Mr. Einstein in the Acetylene Journal for September, 1907:

The "direct feed"—Feeding the carbide by gravity into the water by opening the feed valve which is operated directly by the gas holder bell.

The "indirect feed"—The gas holder bell operates a feeding mechanism which carries the carbide forward to the feed point where it falls into the water.

The "independent feed"—The feed valve is operated by a clockwork or motor mechanism controlled by gas holder bell.

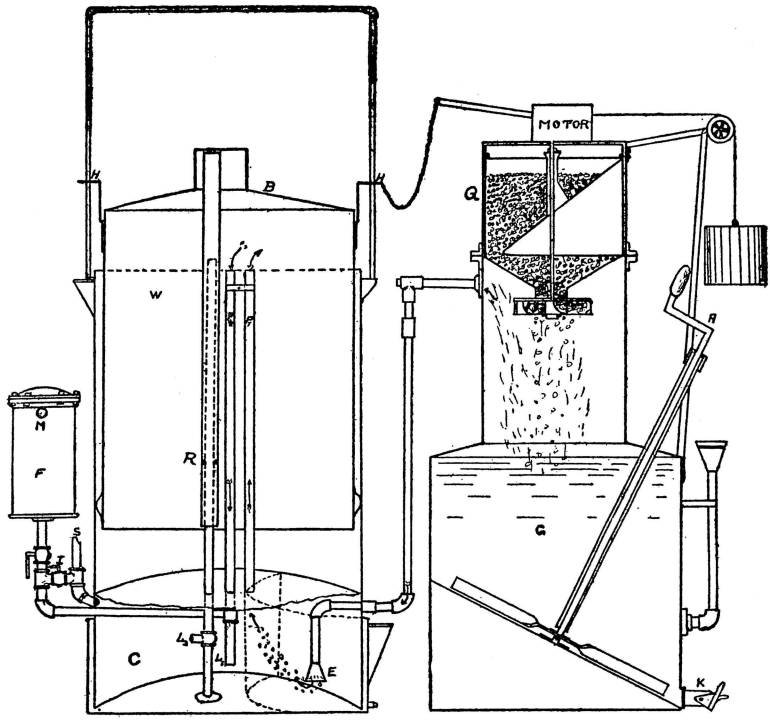
The "indirect independent feed"—A motor or clockwork controlled by

gasholder bell operating a feed mechanism which carries the carbide forward to the feed point.

The indirect independent feed and the direct feed machines are shown in Figures 1 and 2 respectively.

The Acetylene gas machine consists of two essential parts. The generator proper and the gas holder, or gasometer as it is often called. The gasometer by the rise and fall of its gas bell regulates the quantity of gas generated and also serves as a pressure equalizer, supplying the gas to the mains at a constant uniform pressure.

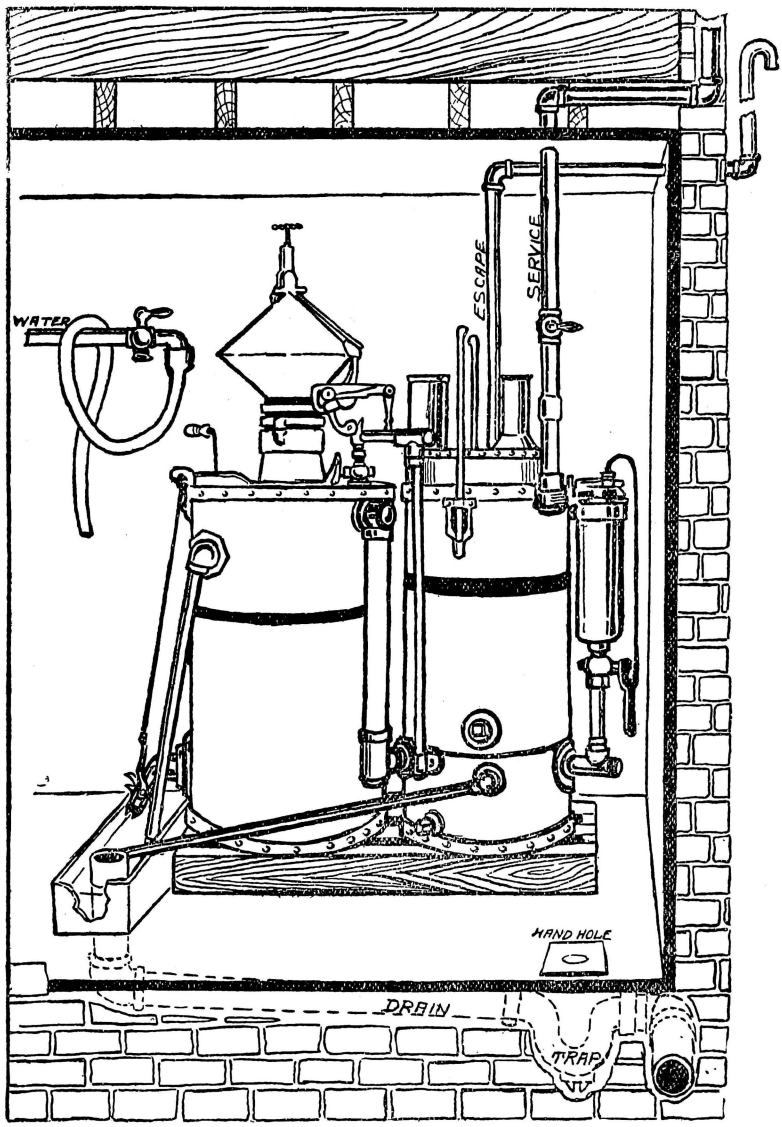
FIG. 1.



A typical carbide feed machine is shown in Fig. 1. The carbide is fed from hopper Q into the body of water G. Gas is generated and passes out into the water seal E. This chamber is partially filled with water. From E the gas passes through the pipe P_1, into the gasometer. The gasometer bell is closed at the top and open at the bottom. It rests in the body of water whose surface is at W. As gas enters the bell rises, thus acting as a storage tank for the gas. The telescopic action of the bell is guided by the rods H. The gas bell supplies gas at a virtually constant pressure through pipe P_2 and filter F to service main at M. When the bell rises to a certain height it stops the weight motor and hence carbide feed. When the bell drops below this point, carbide is again fed into the water until the bell rises above this point. The chamber C is of course filled with water to the same height as the water in E. Hence any undue pressure in gas bell will cause gas to bubble through

open connection at L_1 into chamber C. If the gas bell should accidently rise too high due to a fault in the mechanism or undue after generation, the gas will enter telescopic tube at R and escape through L_2 into C. The chamber C is connected with the open air by the escape pipe S. The

FIG. 2.



by-pass valve I is used should it become necessary to empty gas bell for cleaning or repairs. The generator is cleaned by agitating the contents of G with the mixer A. The mixture of slaked lime and water is then

drawn off from the sludge-cock K. The handle A is water sealed as shown to prevent the escape of gas around same.

In outlining the principles of this gas machine, we have brought out the important features of all high grade Acetylene generators. They all accomplish the same results, embodying the same principles and safety devices and differ mainly in methods of feeding carbide and mechanical details of construction.

In the water feed machine the water is slowly fed to the carbide. The carbide charge is divided in a series of separate compartments and the water gradually feeds in a free flowing stream, thus flooding the carbide. Only one cell is flooded or in operation at a time. The flow of water is governed by the rise and fall of the gas bell. This machine though an evolution of the water feed machines of bygone days, does not embody the features of rational generation as the carbide feed machine does, and hence would be less satisfactory for ordinary purposes. However this type of generator is perfectly safe and reliable and is especially adapted to localities where water is very scarce, since merely enough water is used to completely decompose the carbide, while with the carbide feed machine about one gallon of water per pound of carbide is used.

Prof. George Gilbert Pond, of Pennsylvania State College, says that whatever the type may be, a good generator, such as can be recommended for household use, must be possessed of certain qualities which will be conceded by all:

(1) "It must allow no possibility of the existence of an explosive mixture in any of its parts at any time. The perfect machine must be so constructed that it shall be impossible at any time under any circumstances to blow it up. It must be 'fool proof.'"

(2) "It must insure cool generation."

(3) "It must be substantially constructed of good heavy metal which is not liable to rust and cause leakage and consequent dangerous gas mixtures."

(4) "It must be simple. The more complicated the machine, the sooner it will get out of order. Understand your generator. Beware of a generator whose interior is filled with pipes, tubes, valves, and diaphragms whose functions you do not perfectly understand. If a complicated mechanism is employed to perform what seems to you a simple duty, rely upon your common sense and judgment and look further until you find a perfectly simple but strong mechanism to perform the work automatically of making the gas. There are plenty of them and you can afford to meet the price of the machine which is least likely to call for repairs next season."

(5) "It should create no considerable pressure in any of its parts. More than a pound of pressure at any point may be a source of danger; more than a few ounces is wholly unnecessar y and not to be tolerated."

(6) "It should be capable of being cleaned and recharged without the loss of gas into the room. In a good machine there will be no perceptible odor in its neighborhood."

(7) "It should require little attention. All machines have to be emptied and recharged periodically; but the more this process is simplified and the more quickly this can be accomplished the better."

(8) "It should be provided with a suitable indicator to designate how

low the charge is in order that filling may be done in season and the house not plunged in darkness without notice."

(9) "It should completely use up the carbide, generating the maximum amount of gas."

There are plenty of good generators on the market. No less than 52 are approved by the National Board of Fire Underwriters up to date. For years the country was flooded with many weird devices of a worthless and even dangerous character simply because this field offered so many attractive possibilities to the amateur inventor. Happily these machines have been weeded out and improved until one need select only such machines as are passed upon and approved by the National Board of Fire Underwriters. We are appending the latest approved list of Acetylene Gas Machines. This list includes many excellent and seemingly perfect machines and all on it should be safe and reliable.

PLANNING OF LIGHTING SYSTEM.

When deciding on a lighting plant for the home we might well divide our procedure into several steps. The first and most important is to accurately determine the capacity or size of machine desired. Next we select a particular make of generator. Third, we definitely decide on a location for same. Fourth, we work out the piping scheme for the house. Fifth, we select our fixtures.

CAPACITY OF GENERATOR.

It is important to select a machine of ample size to suit all present requirements and allow a liberal estimate for future outlets. It is far better to install a machine of slightly larger than required capacity, than to find out too late that we have skimped on our original estimate. The additional first cost of a larger machine is slight and the attention required will be less, since it will have a greater carbide capacity and consequently furnish gas from one charge for a longer period of time to the same number of outlets. The National Board of Fire Underwriters advise the following rules for determining the size of generator required:

(1) "For dwellings, and places where machines are used intermittently the generator should have a rated capacity, i. e., pounds of carbide at one charge, equal to the total number of burners installed."

(2) "For stores, opera houses, theatres, day run factories, and similar service, the rated capacity should be from 30 to 50 per cent in excess of the total number of burners installed."

(3) "For saloons and all night or continued service, the rated capacity should be from 100 to 200 per cent in excess of total number of burners installed."

"This rating is based on the so-called ½ foot burner giving a steady illumination of 25 candles and consuming ½ cubic feet of gas per hour. (Burners usually consume from 25 to 100 per cent more than their rated consumption of gas, depending largely upon the working pressure. The so-called ½ foot burner when operated at pressures of from 2 to 2½ inches water column, is usually used with best economy.)" In addition to the ½ foot size of burner, there are the 1½ foot burner rated at 75 candle power, the 1 foot burner rated at 50 candle power, ¾ foot burner rated

at 37 candle power, and the ¼ foot burner rated at 12 candle power. Two ½ foot burners with suitable shades will give plenty of light for the ordinary sized living room with light walls. A good rule to follow is to allow 2 square feet of floor area per candle power where brilliant illumination is desired. Three square feet per candle power will give good light under all conditions.

One ½ foot burner will be found ample for a bedroom unless a wall bracket is desired in addition. Be sure and allow lights for halls, porch, cellar, outhouses and barn.

If heating or cooking units are to be installed make allowances as follows:

Acetylene Range.—Each cooking burner consumes about 3 feet of gas per hour, the oven burner consumes about 5 cubic feet of gas per hour.

Hot Plates.—From 2 to 3 feet of gas per hour.

Small Bedroom Heaters.—About 2¾ cubic feet of gas per hour.

Now reducing everything to equivalent half foot burners and we are in a position to decide on the capacity of our proposed machine.

SELECTION OF GENERATOR.

Having a generator of definite capacity in mind, we are ready to proceed with the selection of our machine. We will in all probabilities settle on the carbide feed type since the small additional amount of water required would be an item in very few communities. If we have no stated preference for any particular make of machine, we had best write to a few representative firms given on the "Approved List" and state our case clearly and concisely. These firms will be glad to take the matter up with us, giving us detailed description of their apparatus with their cost data, advise us as to size, methods of installing and operating their particular machine, etc. Now in making our selection we should be guided by the requirements outlined by Prof. Pond and choose that machine which in our estimate conforms more nearly with these requirements.

A table of average specifications and cost worked out from leading makes of machines is appended.

LOCATION.

We must now decide on the location of our generator. It is preferably located in a special "generator house" built for this purpose, especially if the machine is of large capacity. Such a house should be provided with double walls, be well ventilated and dry, and must if necessary be artificially heated in winter to prevent danger of freezing of water in generator. It is generally more convenient and inexpensive to locate the generator in the basement of an outhouse; or it may even be located in the basement of the main building if the company insuring property consents to same in writing on its policy and it is not prohibited by certain local authorities or boards. The machine must of course be of an approved make and there must be no open jet within ten feet of the machine and it must be placed at least fifteen feet from the furnace.

The machine must be so placed that the operating mechanism will have room for free and full play and can be adjusted **without the aid of artificial light.** It must not be subject to interference by children or med-

dlesome persons, and it may be well to enclose the machine by a slatted partition for this reason. The generator should be placed on a strong, level foundation. If this foundation is of wood it should consist of heavy timbers located in a dry place and open to the circulation of air as shown in Fig. 2.

PIPING.

The generator should be provided with an escape or relief pipe not less than ¾ inch internal diameter. This pipe will be installed without a trap so that any condensation will drain back to generator. It must be carried outside the building and terminate in a properly constructed hood or return bend looking down about 12 feet from the ground. The machine should discharge into a suitable open receptacle for the removal of sludge and water. This receptacle is preferably connected with a drain emptying into a sludge pit or a sewer and much labor in carrying out the lime water with pails will be saved thereby. If the premises are supplied with running water, it will be found convenient to have a tap near the generator for supplying the same with water when it is to be recharged.

If the building is already piped for gas it will only be necessary to connect service pipe in basement with the generator. If, as is usually the case, the building must be specially piped, the schedule for pipe sizes should conform to that commonly used for Acetylene gas, but in no case should the feeder pipes be smaller than ⅜ inch. A schedule of pipe sizes is appended.

The piping work should preferably be done by a regular plumber or gas-fitter. If the services of a plumber are not obtainable, the work can be done by any skillful mechanic such as may usually be found in the small towns. A good man and his helper will be able to completely pipe an average residence in three days' time. If the house is an old one, it may take a little longer to make a good job of concealed work. Competent plumbers will usually agree to pipe a house complete, furnishing all material for from 10 to 15 cents per running foot.

The service connection with the generator is made with a pipe of the same size which in turn leads to a riser of the same size, running up through the building as near the center as possible. The feeders run out from the riser at each floor and these in turn branch off to the fixtures. The feeders and branches should be of ample size as determined by the piping schedule appended.

Black iron pipe should be used with malleable galvanized fittings. Connections from generator to service pipe should be made with right and left thread nipples, or long thread nipples with lock nuts. Unions should never be used for gas fitting. All piping should be pitched to drain back into the generator. If low points occur through necessity, they must be drained through tees into drip cups permanently closed with screw cap plugs. Never use pet cocks. Apply a little white lead to all threads before coupling up to insure gas-tight joints. The piping must be rigidly supported by hooks and straps. Outlets for brackets or drops must be secured by straps or flanges, which are nailed or screwed to the woodwork. Always use fittings in making turns; do not bend pipe. Do not use unions, but instead use long thread, or right and left hand couplings. Long runs of approximately horizontal pipe must be firmly supported at proper intervals to prevent sagging. All longitudinal outlet-pipes must be taken from the

sides or top of running lines, never from below. All ceiling outlets must project not more than 2 inches nor less than 5/8 inch, and must be firmly secured and plumb. Side wall outlets must be firmly secured and must not project more than 5/8 inch and must be at right angles to the wall. Where pipes pass through masonry walls they must be incased. Pipes must be run and covered so as to be readily accessible. Do not run at bottom of floor beams which are to be lathed and plastered. They must be securely attached to the top of the beams which should be notched as shallow as possible. Where pipes are paralleled to beams, they must be supported by strips nailed between the two beams, about four feet apart. Floor boards over pipes should be fastened down by screws, so that they can be readily removed.

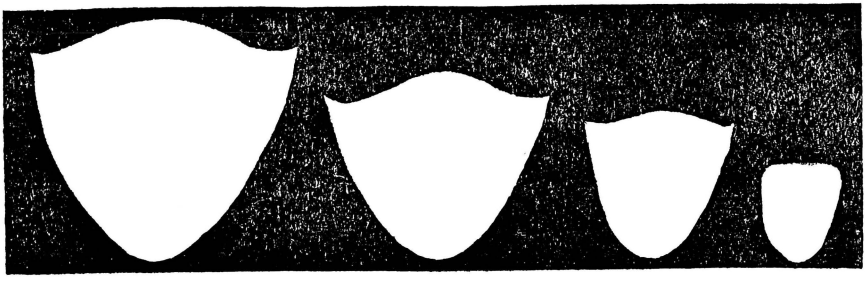
FIXTURES.

In the matter of fixtures one is guided entirely by his own taste and by the amount of money he is willing to appropriate for the purpose. Fixtures may be procured in a variety of styles with from 1 to 4 lights each. The firm selling the generator will furnish a catalog of acetylene gas fixtures or refer to dealers who handle them.

Inexpensive fixtures may be made by building them up from common 1/2" or 3/8" black iron pipe and painting or gilding to suit. Such fixtures are commonly used for store lighting.

The fixtures may be fitted with any of the standard burners already

FIG. 3.



1 cu. ft	3/4 cu. ft.	1/2 cu. ft.	1/4 cu. ft.
50 C. P.	37 C. P.	25 C. P.	12 C. P.

Actual Size and Appearance of Acetylene Flames.

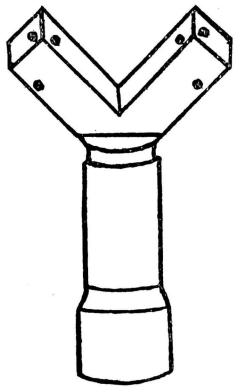
referred to. The actual size of flame produced by these burners is shown in Fig. 3. The appearance and actual size of the ordinary acetylene burner is shown in Fig. 4.

For residence lighting the fixtures should hang about 6 1-3 feet from the floor. For bed-rooms they may be hung slightly lower however, and wall brackets should be placed about 5 1/2 feet from the floor.

When ordering fixtures be sure and measure the ceiling heights and state the length of each fixture in the order.

It is advisable to use globes similar to the Holophane Glass Globes for use with all fixtures and bracket lights where good illumination is desired.

FIG. 4.



Acetylene Burner.
(Actual size.)

These are glass globes or shades constructed along well known optical principles so that they diffuse the light by cutting down the intense glare, with practically no loss by absorbtion. At the same time they increase the useful light below the horizontal. Where reading is to be done it is imperative to have good shades since without these there will be very poor illumination directly below the light. The acetylene flame, due to its high intrinsic brillancy, will dazzle the eye when looked at directly. The light will also cast very sharp shadows due to its small size. All of this will be remedied by the proper use of diffusing globes or shades.

These globes are made in three classes. "Class A"—adapted for use over dining room and library tables, desks, counters, etc., where a strong light is wanted directly downward. "Class B"—for general illumination such as for lighting parlors, bed rooms, stores, etc. "Class C"—designed to give maximum light just below the horizontal, and therefore adapted for use in low chandeliers, wall brackets, etc., where it is desired to light a large area. Especially recommended for illuminating long hallways as corridors, large rooms, etc.

ACCESSORIES.

Electric Ignition. With a special style of automatic burner and an electric ignition outfit, one can have light by the simple pressure of a button on the wall. The battery and coil are concealed in any convenient nearby closet or in the basement. Such an outfit costs in the neighborhood of twelve dollars. It is very convenient and safe for barns where an enclosed light must be used and matches are dangerous. The same sort of an appliance with a chain pull igniter instead of the push button variety may be had for about six dollars. One battery and coil may be used in connection with any number of burners.

HEATERS AND COOKERS.

The heating value of Acetylene is about two and one-half times that for ordinary coal gas. With carbide at its present price this does not make the cost of heating and cooking by acetylene at all prohibitive. This would

certainly be a useful and convenient adjunct to lighting by acetylene, as cookers and heaters of numerous sizes and varieties designed especially for use with acetylene gas are now on the market. Acetylene ranges of the four burner style with a large oven may be purchased at a surprisingly low figure. The consumption of gas per burner is three feet per hour. The oven consumes about five feet per hour, and it is said will bake biscuits in ten minutes. A variety of cookers and hot plates are available. Chafing dish heaters may be had consuming 1½ feet of gas per hour. Bath and bed room heaters are also available.

The portable heaters may be connected with a nearby jet with a rubber tubing. If a gas range or cooker is installed, a permanent connection should be made with the generator by a separate lead.

DESIGN OF A TYPICAL INSTALLATION.

We will now go into the details of a typical installation for a country home whose plans are shown in Figures 5, 6, and 7. On the first floor are Dining and Living Rooms, Parlor, Reception Hall, Pantry, and large front porch. On the second floor are three Bed-rooms, a Store Room, Hall and Bath Room. In the basement there is a Furnace Room, Fuel Room, Laundry and Store Room.

LIGHTING ARRANGEMENT.

Living Room.—This room should be well lighted, since more time is spent here by the family than in any other room in the house. The light should be well distributed below the horizontals to admit of several persons reading in the room at the same time. Accordingly we select a two-light fixture with ¾-ft. burners and Holophane Shades, Class B. This will give a very brilliant lighting below the horizontal and also good general illumination over walls and ceiling.*

Dining Room.—Brilliant illumination is desired over the table. We will select a two-light fixture hung in the center of the room with ¾-ft. burners and Class A Holophane Globes.

Kitchen.—Here the housewife spends a great part of her time. The operations carried on here are of vital interest and importance to the entire family. It should be well lighted though not so brilliantly as the dining room. A simple two-light fixture with ½ ft. burners and Class B Holophane Globes will suffice here.

Parlor.—A two-light fixture with ½ ft. burners will be ample for this room. We may use Holophane Globes of Class B type, or select globes of a more elaborate or tasteful design to harmonize with the general scheme of decorations in the room.

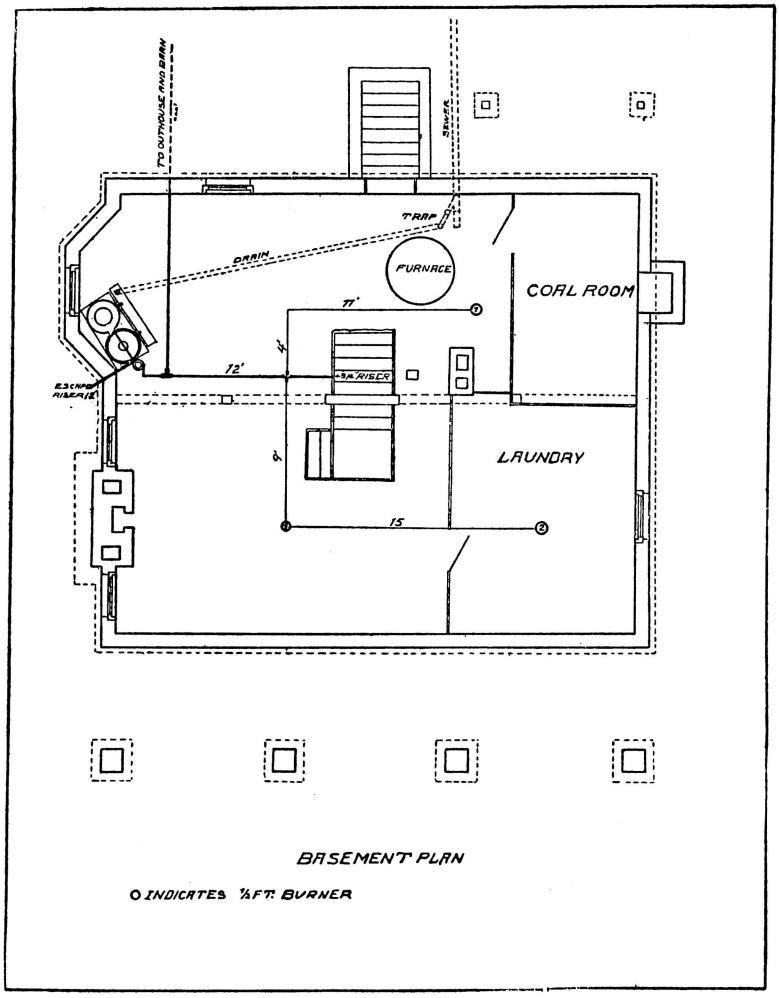
Pantry and Bath Room.—One-light fixtures with ½ ft. burners and Class B shades.

Halls.—One-light fixtures with ½ ft. burners and Class C shades should be used for the halls.

Front Porch.—A regular porch light fixure with a ½ ft. burner and suitable globe and canopy to protect it from wind will be used here.

Bedrooms.—These chambers are each fitted with one-light ceiling fixtures with ½ ft. burners and Class B globes. These ceiling fixtures are

FIG. 5.



hung about 6 ft. off the floor. "Two swing" brackets with ½ ft. burners and Class C globes are placed on wall in each room so as to give a good light near mirror to dress by. These brackets should be placed about 5½ feet off the floor.

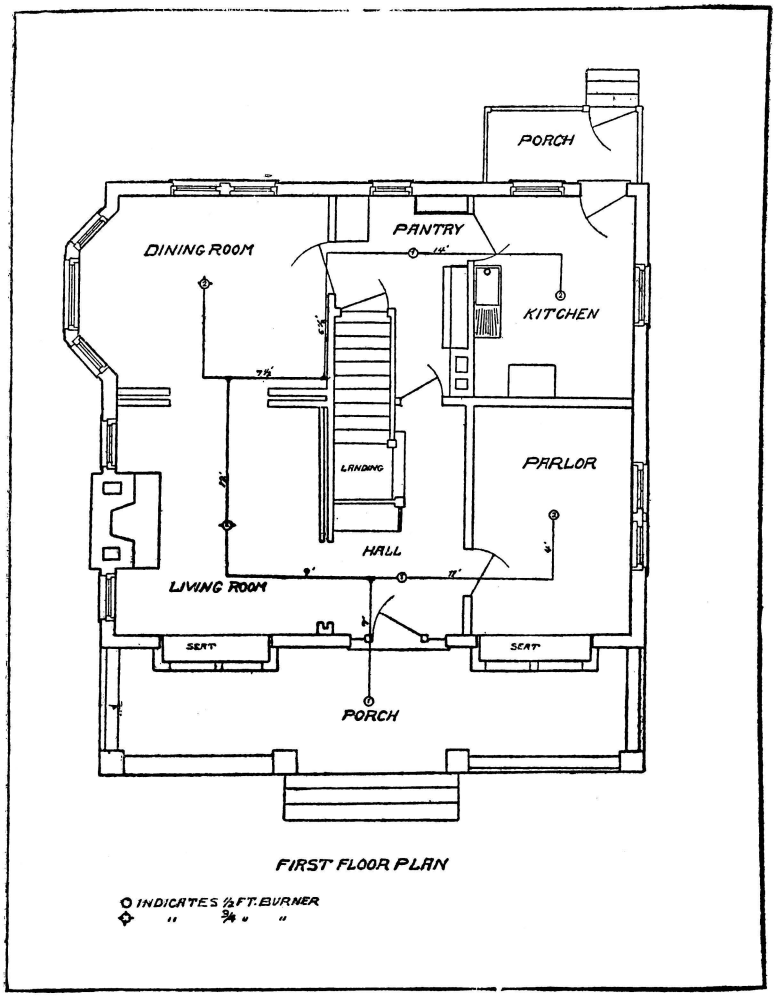
Basement.—An open ½ ft. burner is placed near the furnace. One is also placed in the store room. A short two-light bronze spread equipped with ½ ft. burners is placed in the laundry. It will be noticed that light is placed in the vicinity of the generator.

Outhouse and Barn.—The outhouse is equipped with two ½ ft. wall bracket burners. The area way of the barn is lighted by an enclosed ¾ ft. burner equipped with an electric chain pull igniter.

CAPACITY OF GENERATOR.

Adding up all of our outlets we find that we have twenty-two ½-ft. and five ¾ ft. burners. The equivalent is about thirty ½ ft. burners. We

FIG. 6.



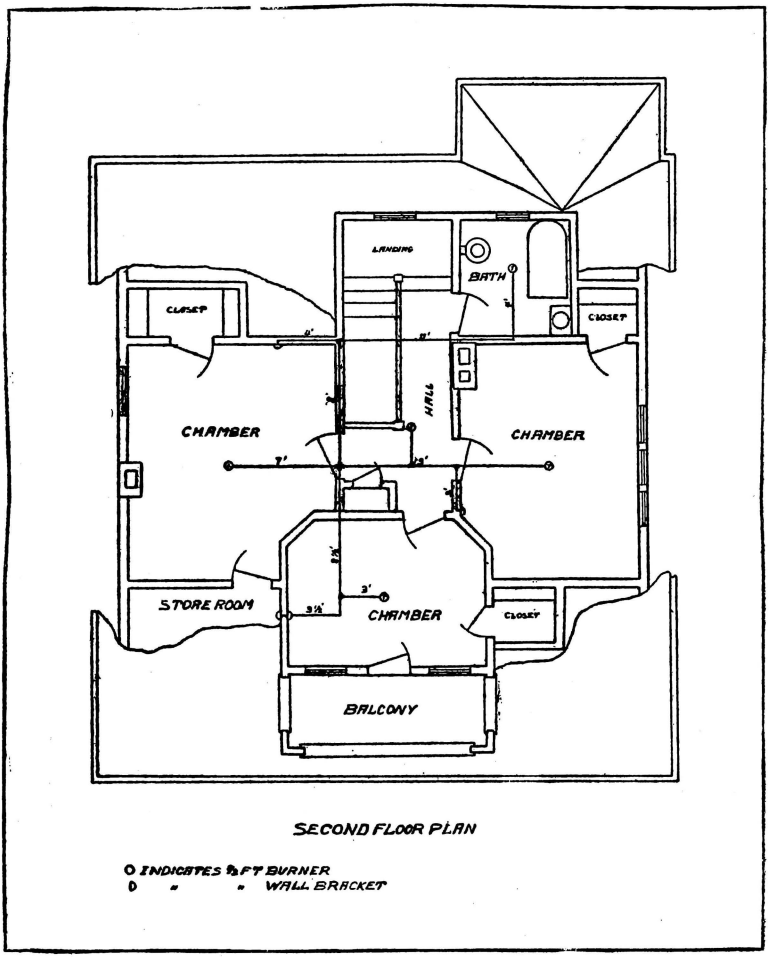
will select a "size 50" or 50 light generator, since this will allow for any under-rating of the burners and also allow liberally for future extension.

INSTALLATION AND PIPING.

We will assume that the company insuring the property consents to our placing the generator in the basement. We will thus be saved the added expense of an outhouse which would have to be specially heated in

the winter. The machine will be placed about 20 feet from the furnace near the basement window. A nearby window is desirable so that all cleaning and charging may be done without the aid of artificial light. A wooden

FIG. 7.



foundation is made for the generator as shown in Fig. 2. A trough of heavy galvanized iron about 8″ x 8″ x 26″ is placed in front of the machine and connected with a 2″ drain which in turn leads to the sewer through a suitable trap. This trough and drain will merely be an added convenience and may be dispensed with if it is proposed to use the sludge for some practical purpose when it is emptied from the machine. However, if drain is to be used never connect directly with a sewer, but let generator first discharge into a suitable open receptacle which may in turn have such connection.

A 1 inch escape pipe is led outside and terminates in a weather bend about 12 feet from the ground. A ¾ inch service pipe connects with gen-

erator through a long thread nipple with lock nuts. The service pipe is led to a ¾ inch riser which reaches the ceiling of the second floor. Half inch feeder pipes are led off from the riser at each floor as shown. These feeders in turn branch off into ⅜ inch pipes which lead to the outlets. The reductions of ½ inch to ⅜ inch are clearly indicated on the plans which show piping arrangement, Fig. 5-6-7.

A ¾ inch galvanized pipe is laid underground to supply two ½ ft. burners in an outhouse and a ¾ foot burner in the barn. The total length of this outside piping system is 200 feet.

ESTIMATED FIRST COST OF INSTALLATION.

Piping System.

18 feet of 1 inch pipe, 235 feet of ¾ inch pipe, 40 feet of ½ inch pipe, 177 feet of ⅜ inch pipe	$ 22.00
Pipe Fittings	5.00
Labor, 1 man at $3.50 per day for 4 days	14.00
Labor, 1 man at $1.50 per day for 4 days	6.00
Total Cost of Piping	$ 47.00

Drain.

Galvanized iron trough	$ 2.00
20 feet of 2 inch pipe	2.60
Fittings, trap, etc.	3.00
Labor	2.00
Total Cost for Drain	$ 9.60

Foundation for Generator.

Wood open work Foundation	$ 1.00

Fixtures.

Dining Room, Living Room, Parlor: Two-light, polished brass finish, turned brass fittings	$ 16.50
Pantry: One light bronze	1.00
Kitchen: Two light bronze	2.00
Hall: One light polished brass	3.50
Porch: One light crystal globe, canopy windguard	5.50
Bed-rooms: Three, one light polished brass	6.00
Bed-rooms: Three brackets, 2 swing, polished brass	4.50
Bath-room: One light, polished brass	2.00
Hall Upstairs: One light, polished brass	2.00
Basement: Two one light bronze	2.00
Laundry: Two one light bronze	2.00
Outhouse: Two bronze brackets	1.40
Barn: Enclosed globe with chain pull igniter and accessories	13.00
Total	$ 61.40
Discount at 20 per cent	12.28
Actual Cost	49.12

2 Dozen Holophane Globes	16.00
2 Dozen 2¼ inch Holders	3.00
Total	19.00
Discount at 33 1-3 per cent	6.32
Actual Cost	12.68
2½ Dozen Acetylene Burners	6.00
50 Light Generator	158.00
Cost of Installation Complete	$283.40

Allowance for freight and incidentals will bring this figure to $290.00.

TOTAL ANNUAL COST.

The actual cost of Acetylene at the rate of ½ foot of gas per hour with carbide giving 4½ feet of gas per pound and costing $4.00 per 100 pounds, would be ½ cent per hour. This would be the cost of operation for a burner consuming ½ foot of gas per hour. However, the total annual cost based on such a figure as this would be of little value since no allowance has been made for fixed charges. To estimate these we assume a 5 per cent interest rate, and a 4 per cent rate of depreciation on the generator, (the life of the generator is rather uncertain since it depends materially on its location and the attention it receives, such as thoroughly cleaning and painting it about once a year), and 2 per cent on the piping and fixtures. We will allow 1½ per cent for taxes and repairs. Now in order to know the amount of carbide which would be used per year, we will have to approximate the gas consumption of our lighting arrangement. The gas used per day will of course vary with the season, being considerably higher during the winter days than during the summer. A careful study of the number of hours each burner is likely to be used will give an average gas consumption of 12 cubic feet per day for the year round. Assuming our carbide as giving an average yield of 4½ cubic feet of gas per pound, we would use annually 975 pounds. The generator would need recharging on the average every 18 days. Now our total yearly cost will be:

Carbide: 975 pounds at $4.00 per 100 pounds	$ 39.00
Interest on $290.00 at 5 per cent	14.50
Depreciation on generator at 4 per cent	6.32
Depreciation on piping and fixtures at 2 per cent	2.64
Taxes and repairs at 1½ per cent	4.35
Total Yearly Cost	$ 66.81

This is about $2.20 per equivalent half foot burner installed.

A CHEAPER INSTALLATION.

In making the above estimates liberal allowances have been made and the design is perhaps more elaborate than desired for the average country home.

We may reduce the cost of the above installation materially as follows: Omit the drain in cellar and arrange to carry out the sludge in buckets or pump it out with a small pump and hose attachment which is made for that purpose. Omit light in barn and on the porch. Bronze instead of polished brass fixtures in bed rooms. Using a 35 light generator instead of the 50

light machine will reduce the cost by $23.00 alone. The total first cost of this installation would now be in the neighborhood of $225.00.

By turning out lights when not needed the carbide consumption for such an installation may be reduced to 650 pounds per annum.

The total annual cost will now be:

Interest on $225.00 at 5 per cent	$ 11.25
Depreciation, Repairs, Taxes	10.50
Carbide 650 Pounds at $4.00 per 100 pounds	26.00
Total Yearly Cost	$ 47.75

These figures it will be understood are merely estimates made to cover the average case and will vary for different localities and with the extent of the installation. However, they will serve as a guide to those interested in applying them to their individual proposed installations.

CARE OF APPARATUS.

Rules and requirements of the National Board of Fire Underwriters for the construction, installation and use of Acetylene Gas machines and for the storage of Calcium Carbide, may be obtained from your insurance agent or by writing to Secretary's office, National Board of Fire Underwriters, No. 207 East Ohio Street, Chicago, Ill.

Complete directions for operation and care of apparatus will accompany the generator. However, we deem it advisable to point out some of the more important points to be considered in general where using any Acetylene Gas Machine.

Always recharge generator before carbide is entirely consumed, and observe a regular time during daylight hours only for attending to and recharging the apparatus. The sludge should be emptied from generator and it should be thoroughly flushed, then filled with clean pure water each time the carbide hopper is recharged.

The semi-liquid residue drawn from the generator may be used for white washing, as a fertilizer, insecticide, and disinfectant. The lime will make mortar which will set quickly and hard.

It is often convenient and inexpensive to let the drain from generator empty into a sludge pit where the lime will accumulate and can subsequently be used.

The water in the gas holder should be drained off once or twice a year and the holder thoroughly cleaned. The felt in the filter will need occasional renewing. This is easily observed by the dimming of lights when all are all turned on, due to the pressure of gas falling below normal in passing the felt. Always keep the tanks and seals filled with clean water.

When starting up a new installation open all burners till gas has forced the air out of the pipes before attempting to light burners.

Never test the generator or piping for leaks with a flame and never apply a flame to an outlet from which the burner has been removed.

Never use a lighted match, lamp, candle or lantern near the machine.

Never pack or ram the carbide in the hopper and use only such size of carbide as the directions call for.

If the generator is installed in a separate generator house, this house should be thoroughly ventilated and any artificial heating necessary to prevent freezing shall be done by steam or hot water systems.

STORAGE OF CALCIUM CARBIDE.

Calcium Carbide in quantities not to exceed 600 pounds may be stored when contained in drums not exceeding 100 pounds each, inside insured property, provided the place of storage is dry, weatherproof and well ventilated and also provided that all but one of the packages shall be sealed until the unsealed can has been completely used up.

In excess of 600 pounds, packages must be stored above ground in detached buildings used exclusively for this purpose, being dry, well ventilated and weatherproof.

VILLAGE PLANTS.

Lighting by Acetylene is not necessarily limited to residences or single buildings. Plants are being annually installed of sufficient size to illuminate towns of from 400 to 3,000 inhabitants. This furnishes a cheap, effective, and very satisfactory method of lighting small towns where coal gas plants would be failures and electric plants doubtful propositions.

The operating expense of a village plant is very low, since the services of but one man are required about one or two hours per day in attending and recharging the generator. The rest of the time the generator house is locked up and the generator takes care of itself.

Such a plant as we have already mentioned, is equipped with a non-automatic generator and a gas holder of sufficient capacity to contain at least four cubic feet of gas per ½ foot burner of the rating.

The carbide is fed into the water by hand or by a small water motor so that a slow and steady feed is assured. It is customary to generate enough gas at one time to last at least over a single night and often for several nights. Ample storage is desired so as to avoid the possibility of the gas supply ever failing and being turned on again while the burners are still open.

The station apparatus consists of a generator which is equipped with a cast iron filter, seal pot and suitable feeding device. Also, a station meter which is of sufficient capacity to measure all gas supplied from gas holder to the mains, a heating apparatus installed in a separate room and of sufficient size to keep the generator room at 50 degrees Fahrenheit in zero weather and a residuum drain of 6 inch vitrified terra cotta pipe connecting discharge gate of generator with an outside pit. The water supply is furnished by a standard pressure water system for supplying all water necessary for operation of plant, including the driving of the water motor such as is used for operating the feeding device. This water supply may be furnished by an elevated tank supplied by a pump and gasoline engine or windmill.

The gas holder is constructed in accordance with specifications furnished by the firm selling the generator. All mains and supply pipes are also installed in accordance with these specifications.

The price on a complete station equipment made to us by a prominent manufacturer of a non-automatic central station generator was $2500.00. The plant has a capacity of 1,000 cubic feet of gas per hour, and the gas holder has a capacity of 1500 cubic feet. A larger generator having a capacity of 2500 cubic feet of gas per hour and a gas holder of 3000 cubic feet capacity, would cost about $3300.00. These prices include hot water heating plant installed, station meter, etc. The smaller size would be ample for a

town of 1500 inhabitants or less. The larger size for 3000 inhabitants or less.

The cost of installing, mains, etc., will of course depend entirely on local conditions. However, the first cost of a municipal Acetylene lighting plant for a small town will be less than any other kind of lighting system. The cost of operation will certainly be much lower.

Small towns which have heretofore been in darkness simply due to the fact that a gas or electric plant could not be made to pay, may be beautifully and economically lighted by Acetylene.

We have in mind a small town in the State of Minnesota of about 500 inhabitants. They have a municipal Acetylene lighting plant which has been giving satisfactory service for eleven years. The gas is metered to the consumers at a rate of $1.25 per 100 cubic feet. The village allows a flat rate of $2.00 per month each for the town street lamps. This plant has a capacity of 1000 cubic feet of gas at a charge and requires the attention of one man a half hour each day. The first cost of this plant was $3500.00 as installed eleven years ago.

A pressure equivalent to a 4½ inch water column is maintained on the gas in the mains. This rather high pressure is necessary to force the gas in sufficient quantities to the ends of those service pipes which extend considerable distance from the plant.

The Union Carbide Company makes a rate of $60.00 per ton to municipal plants.

APPENDIX

RESULTS OF TESTS.

We conducted a series of tests in our laboratory in order to observe the actual consumption of gas for various rated burners and also to determine the cubic feet of gas available per pound of carbide under service conditions.

The generator used for the test was a 35 light carbide feed machine which was loaned to us by the Eagle Generator Company of St. Louis, Missouri.

The arrangement of generator, meters and burners for the test is shown in Fig. 8.

A Junker's Wet Meter was used for measuring the gas consumption of the burner's per hour. A Maryland 3 light meter was also connected in the service line and carefully callibrated to measure the total quantity of gas used from a charge of carbide.

A pressure equivalent to a 2½ inch water column was maintained on the gas with an average temperature of 70 degrees Fahrenheit throughout the test on the burners.

We found that the ½ foot burners were but very slightly underrated but that the larger sizes of Eagle burners seemed to be somewhat overrated. The results were as follows:

Eagle Burners.

Rating of Burner in cubic feet per hour.	Actual consumption Cubic feet per hour.
1½	1.04
1	.785
¾	.584
½	.537
¼	.360

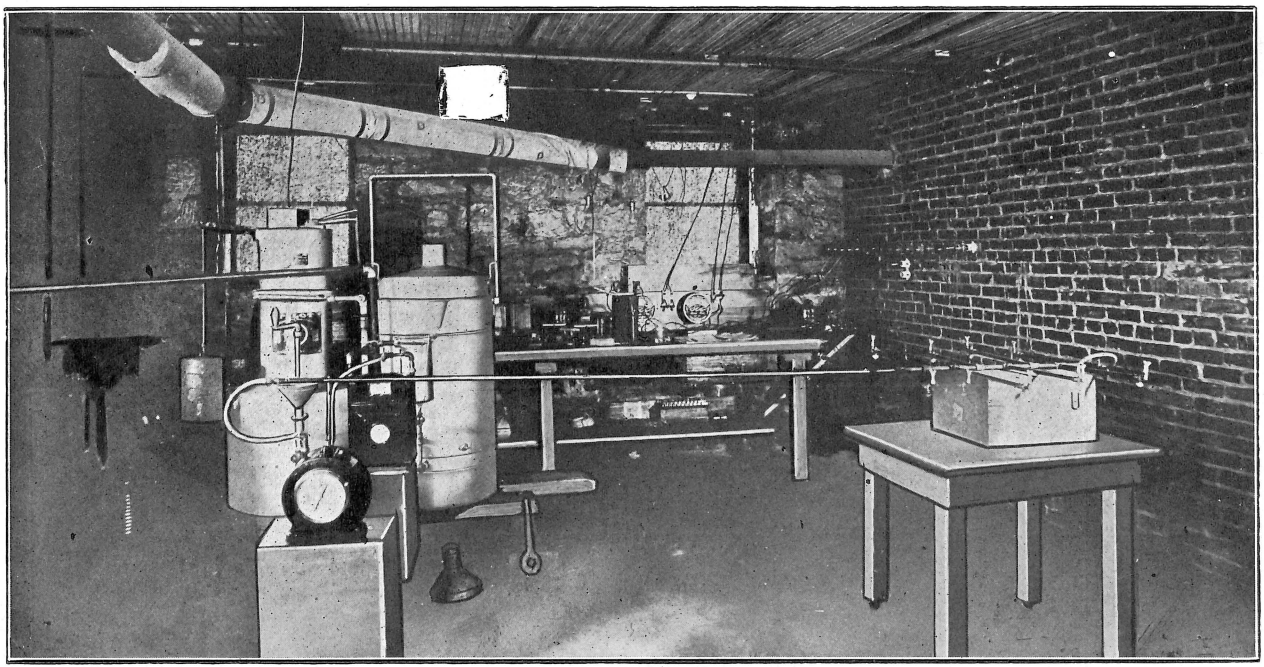
Colts Von Schwarz Perfection Burners.

1	1.01
¾	.811
½	.524
¼	.35

These figures were averaged from four runs on two burners of each size.

Carbide from two different drums was tested. The contents of the first drum was very dusty and a strong odor of Acetylene prevailed when the drum was opened, indicating a slightly air-slaked condition. The average gas yield from carbide of this drum was 4.1 cubic feet per pound. Carbide tested from the second drum yielded 4.67 cubic feet of gas per pound. These are the actual figures which would be obtained under service conditions, as the usual procedure of expelling air from the generator was gone through when starting up, and the gas was burned from a bank of burners several hours each day until the charge was exhausted.

FIG. 8.



35 Light Carbide Feed Generator Arranged for Test.

APPROXIMATE DIMENSIONS AND COST OF AUTOMATIC ACETYLENE GENERATORS.

Rating—No. ½ Foot Lights.	Carbide Capacity—Pounds.	Height Required—Inches.	Floor Space Required—Inches	Width of Door Required—Inches.	Service Pipe—Inches.	Weight—Gross—Pounds.	Price—Dollars.
20	20						100
25	25	75	24x40	22	½	250	120
30	30						135
35	35	80	27x58	25	¾–1	425	150
40	40						160
50	50	86	28x60	26	¾–1	500	175
75	75						250
100	100	92	34x68	30	1–1½	600	300
150	150						400
200	200	116	48x75	38	1 ½–2	1200	550
300	300						750
500	500	120	75x130	48	2	2500	1050
1000	1000						1650

Note:—The above are list prices and are usually subject to 10 per cent. or more discount.

PIPING SCHEDULE FOR ACETYLENE GAS.

No. ½ ft. Burners	DISTANCE IN FEET AND SIZE OF PIPE REQUIRED													
	10	20	30	40	50	60	75	100	125	150	200	300	400	500
10	⅜	⅜	⅜	⅜	⅜	⅜	⅜	½	½	½	½	¾	¾	¾
20	⅜	⅜	½	½	½	½	½	½	½	½	¾	¾	¾	¾
30	½	½	½	½	½	¾	¾	¾	¾	¾	¾	¾	1	1
40	½	½	½	½	¾	¾	¾	¾	¾	⅜	¾	1	1	1
50	½	½	¾	¾	¾	¾	¾	¾	¾	1	1	1	1	1
60	½	½	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1
75	½	¾	¾	¾	¾	1	1	1	1	1	1	1	1 ¼	1 ¼
100	¾	¾	¾	¾	1	1	1	1	1	1	1	1 ¼	1 ¼	1 ¼
150	¾	¾	1	1	1	1	1	1	1	1 ¼	1 ¼	1 ½	1 ½	1 ½
200	¾	1	1	1	1	1	1 ¼	1 ¼	1 ¼	1 ½	1 ½	1 ½	1 ½	2
250	1	1	1	1	1 ¼	1 ¼	1 ¼	1 ¼	1 ¼	1 ½	1 ½	2	2	2
300	1	1	1 ¼	1 ¼	1 ¼	1 ¼	1 ¼	1 ½	1 ½	1 ½	1 ½	2	2	2
400	1	1 ¼	1 ¼	1 ¼	1 ½	1 ¼	1 ½	1 ½	1 ½	2	2	2	2	2 ½
500	1 ¼	1 ¼	1 ½	1 ½	1 ½	2	2	2	2	2	2	2	2 ½	2 ½

CORRECTION SLIP

"ACETYLENE LIGHTING FOR COUNTRY HOMES"

May 20, 1912.

The list of Acetylene Manufacturers given in this bulletin is out of date as I understand it is revised every six months. I understand further that correct and up to date lists can be obtained through local fire insurance agents or by writing direct to the Underwriters Laboratories, 207 East Ohio Street, Chicago, Illinois.

H. B. SHAW,
Editor.

LIST OF ACETYLENE GAS MACHINES.

which have been examined under the Rules and Requirements of

THE NATIONAL BOARD OF FIRE UNDERWRITERS

By Its Committee of Consulting Engineers

and which may be permitted for the uses specified when installed according to requirements if not in violation of any state law or local ordinance, and

IF THE COMPANY INSURING THE PROPERTY CONSENTS TO THE SAME IN WRITING ON ITS POLICY

To secure the largest measure of safety to life and property, Acetylene Gas Machines must be installed out side of buildings, and the National Board Rules strictly observed.

It should be noted that the installation of acetylene gas machines inside of buildings is prohibited in certair districts by local authorities and local boards.

The following named Acetylene Generators made by the persons and firms whose names are given have been examined and tested under the direction of this Committee, the factory practices used by these concerns are inspected from time to time and the manufacturers are under agreement to furnish for sale under thesse names only devices which are similar in all respects to samples and specifications on file at the Underwriters' Laboratories.

They are safeguarded to as great an extent as it is possible to safeguard appliances of this character.

Be sure that the trade-name, and the name of the manufacturer, as given in the list, are marked on the machine, and that the generator purchased is of the type manufactured since the date of the examination.

Follow carefully the Rules for Proper Installation, Care and Maintenance of Acetylene Generators, a copy of which may be obtained from your insurance agent.

CLASS A.

Stationary Apparatus For Isolated Installations.

Acetylene Report No.	Name of Machine	Manufactured by	Manufactured at	Date of Original Exam.	Date of Last Re-exam.
198	Abner Giant	The Krein Mfg. Co	Wapakoneta, Ohio	July 1909	June 1908
260	Abner, Jr	The Krein Mfg. Co	Wapakoneta, Ohio	March 1901	Feb. 1909
372	A Free Light	Martin Bros.	Maryville, Mo	April 1905	Sept. 1908
261	Aurora	Hercules Mfg. Co	Chattanooga, Tenn	July 1901	May 1908
473	Beloit	Acetylene Gas Machine Co	Beloit, Ohio	June 1909	.....
34 3	Ben Hur	The Johnson Acetylene Co	Crawfordsville, Ind	Jan. 1902	April 1908
482	Birch	Birch Acetylene Co., Chicago, Ill	Elkhart, Ind	Sept. 1909	.....
438	Brauer	Brauer Acetylene Lighting Co	Marshalltown, Iowa	Jan. 1907	Aug. 1909
40	Buckeye	National Light and Heating Co	Freeport, Ohio	April 1898	May 1908
419	Bunnell	Robinson & Love	Sycamore, Ill	March 1906	Sept. 1909
373	Carter	Niagara Falls Acetylene Gas Machine Co.	Niagara Falls, N. Y	Jan. 1903	July 1909
216	C. K. Sober	C. K. Sober	Lewisburg, Pa	Nov. 1899	Feb. 1909
346	Colt, Model N	J. B. Colt Co	New York, N. Y	April 1902	Sept. 1909
420	Colt, Model O	J. B. Colt Co	New York, N. Y	Nov. 1905	Sept. 1909
434	Comet	Comet Acetylene Apparatus Co	Alexandria, Minn	Aug. 1906	Aug. 1907
211	Condon's	U. S. Acetylene Co	Philadephia, Pa	June 1907	Feb. 1909
337	Davis, Model B	Davis Acetylene Co	Elkhart, Ind	Dec. 1901	March 1909
383	Davis, Model C	Davis Acetylene Co	Elkhart, Ind	April 1903	March 1909
36	Daylight	Daylight Acetylene Gas Co	Louisville, Ky	March 1898	Aug. 1909
450	Daytonia	St. Clair Mfg. Co	Dayton, Ohio	Sept. 1907	Oct. 1909
1	Eagle	Eagle Generator Co., St. Louis, Mo	Chicago, Ill	June 1897	March 1908
265	Gate City	Visser & Brown	Keokuk, Iowa	April 1901	Aug. 1909
391	General	Commercial Acetylene Co	New York, N. Y	Sept. 1903	April 1909
369	Grand Rapids	G. F. Owen	Grand Rapids, Mich	Jan. 1903	Feb. 1909
418	Hays	J. T. Hays & Son	Emmitsburg, Md	Jan. 1907	Feb. 1909
448	Hercules	Hercules Mfg. Co	Chattanooga, Tenn	Jan. 1907	May 1908
365	Higgs	Davis Acetylene Co., for Home Carbide Co., Chicago, Ill	Elkhart, Ind	Jan. 1903	March 1909
440	Holm	Springfield Acetylene Generator Co	Springfield, Ohio	Dec. 1906	Feb. 1909
482	Hunter	Hunter's Gas Co., Chicago, Ill	Elkhart, Ind	Sept. 1909	.....
240	Ideal Epworth, TypeD	Ideal Epworth Acetylene Co	Waterloo, Iowa	Sept. 1900	Sept. 1900
240	Ideal Epworth, TypeD	Ideal Epworth Acetylene Co	Johnstown, Pa	March 1907	Oct. 1909
403	Illinois	Monmouth Acetylene-Electric Mfg. Co	Monmouth, Ill	Nov. 1905	March 1909
338	King	C. A. King	Norwich, N. Y	Oct. 1902	Jan. 1908
71	Laun	Laun Bros	Chicago, Ill	Aug. 1898	Feb. 1908
464	Model	National Welding & Mfg. Co	Buffalo, N. Y	May 1908	Sept. 1909
253	Monarch Carbide Feed	Monarch Acetylene Gas Co	Buffalo, N. Y	July 1904	Sept. 1909
410	Night Commander	United States Standard Co	Voorheesville, N. Y	Aug. 1905	Nov. 1907
282	Orion	Matteson Acetylene Gas Generator Co., successors to Boonville Acetylene Generator Co., Boonville, N. Y	Pulaski, N. Y	Oct. 1904	Jan. 1908
340	Phelps Carbide Feed	The New England Mfg. Co., Chicago, Ill	Elkhart, Ind	April 1903	Aug. 1909
468	Phelps Limited Feed	The New England Mfg. Co., Chicago, Ill	Elkhart, Ind	Sept. 1909	.....

CLASS A—Continued.

Acetylene Report No.	Name of Machine	Manufactured by	Manufactured at	Date of Original Exam.	Date of Last Re-exam.
454	Phelps Measured Feed	The New England Mfg. Co., Chicago, Ill..	Elkhart, Ind.....	July 1907	March 1909
404	Pilot, Model B.....	The Acetylene Apparatus Manufacturing Co.	Chicago, Ill.....	Oct. 1904	Jan. 1909
386	Pilot, Model C.....	The Acetylene Apparatus Manufacturing Co.	Chicago, Ill.....	Feb. 1903	Jan. 1909
428	Pilot, Model D.....	The Acetylene Apparatus Manufacturing Co.	Chicago, Ill.....	May 1905	Jan. 1909
381	Radiant.....	The Rush Acetylene Generator Co.....	Canandaigua, N. Y....	Feb. 1903	Dec. 1908
388	Reliance.....	The Gem City Acetylene Generator Co....	Dayton, Ohio.....	Dec. 1904	March 1909
482	Stiles.....	The New England Mfg. Co., Chicago, Ill., for W. E. & A. Stiles, West Chazy, N. Y.	Elkhart, Ind.....	Sept. 1909	.....
482	Strimple.....	The New England Mfg. Co., Chicago, Ill. for Strimple's Acetylene Co., Peoria, Ill.	Elkhart, Ind.....	Sept. 1909	.....
354	Sunlight Omega.....	Sunlight Gas Machine Co.....	New York, N. Y.....	July 1902	Sept. 1909
347	Victoria, Model B.....	Victoria Mfg. Co.....	Auburn, Me.....	Feb. 1902	Sept. 1909
385	Western.....	Western Gas Company, Chicago, Ill.....	Reddick, Ill.....	Sept. 1908	.....
430	Aceterator.....	General Light Co.....	Philadelphia, Pa.....	Sept. 1906	Feb. 1909
	This generator is considered suitable for use only when installed in a masonry pit, with the generating water below the frostline, located outside of and at least 30 feet removed from buildings.				

CLASS B.

Stationary Apparatus for Central Station Service.

Acetylene Report No.	Name of Machine	Manufactured by	Manufactured at	Date of Original Exam.	Date of Last Re-exam.
239	Williamson.....	Acetylene Apparatus Mfg. Co.....	Chicago, Ill.....	April 1902	Jan. 1909

CLASS D.

Portable Table Lamps.

Acetylene Report No.	Name of Lamp	Manufactured by	Manufactured at	Date of Original Exam.	Date of Last Re-exam.
429	Beck Iden.....	Acetylene Lamp Co.....	New York, N. Y.....	Sept. 1905	June 1908

CAUTIONS.

1.—Calcium carbide should be kept in water-tight metal cans, by itself, outside of any insured building under lock and key, and where it is not exposed to the weather.

2.—A regular time should be set for attending to and charging the apparatus during daylight hours only.

3.—In charging the generator chambers of water-feed machines, clean all residuum carefully from the containers and remove it at once from the building. Separate from the mass any unslaked carbide remaining, and return it to the container, adding new carbide as required. Be careful never to fill the container over the specified mark, as it is important to allow for the swelling of the carbide when it comes in contact with water. The proper action and economy of the machine are dependent on the arrangement and amount of carbide placed in the generator. Carefully guard against the escape of gas.

4.—Whenever recharging with carbide always replenish the water supply.

5.—Never deposit residuum or exhausted material from water-feed machines in sewer pipes or near inflammable material.

6.—Water tanks and water seals must always be kept filled with clean water.

7.—Never install more than the equivalent of the number of half-foot burners for which the machine is rated.

8.—**Never test the generator or piping for leaks with a flame, and never apply flame to an outlet from which the burner has been removed.**

9.—**Never use a lighted match, lamp, candle, lantern or any open light near the machine.**

10.—See that the entire installation is in accordance with the rules of the National Board of Fire Underwriters, a copy of which will be furnished by your insurance agent, and obtain from your contractor a written guarantee that these rules are complied with.

Note.—Failure to observe the above cautions is as liable to endanger life as property.

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Local Identifier Bowles1910

Capture information

Date captured	2018 February
Scanner manufacturer	Ricoh
Scanner model	MP C4503
Scanning software	
Optical resolution	600 dpi
Color settings	Grayscale, 8 bit
File types	Tiff

Source information

Format	Book
Content type	Text
Notes	Digitized duplicate copy not retained in collection.

Derivatives - Access copy

Compression	LZW
Editing software	Adobe Photoshop
Resolution	600 dpi
Color	Grayscale, 8 bit
File types	Tiffs converted to pdf
Notes	Greyscale pages cropped and canvassed. Noise removed from background and text darkened.