DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
George K. Burgess, Director

CIRCULAR OF THE BUREAU OF STANDARDS, No. 327

SELECTION AND CARE OF GARDEN HOSE

APRIL 20, 1927

PRICE 10 CENTS
Sold only by the Superintendent of Documents, Government Printing Office
Washington, D. C.

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1927

GARDEN HOSE[1]

ABSTRACT

This circular presents information relative to garden hose which is intended as an aid in its selection, use, and preservation. The design and manufacture of the three types of hose commonly used and known as "wrapped," "braided," and "cotton rubber-lined" are described in some detail. Simple methods of inspection and test are described in a nontechinal way, and suggestions are offered as an aid in the selection of hose to meet different conditions of service. Detailed directions as to the use and care of garden hose are given, and a chart shows graphically the discharge capacities of ½, ⅝, and ¾ inch hose under different pressures.

CONTENTS

I. INTRODUCTION

The average person, having little knowledge of the construction and relative value of different kinds of garden hose, may be guided largely by price or appearance, or he may be influenced by a familiar trade name. The casual buyer in the absence of adequate facilities for determining quality is at a disadvantage by reason of the many brands of hose on the market, each with attractive claims for serviceability not always in strict accord with the real value.

II. CONSTRUCTION OF GARDEN HOSE

There are three general types of garden hose, known as "wrapped," "braided," and "cotton rubber-lined." The construction of each type is illustrated in Figure 1.

1. WRAPPED HOSE

This type of hose consists of an inner rubber tube, plies of cotton sheeting or cotton duck, and a rubber cover. The tube is formed in an extruding machine (fig. 2) by forcing a rubber compound through a

[1] Prepared by P. L. Wormeley, chief of rubber laboratory of the Bureau of Standards, assisted by W. L. Holt.

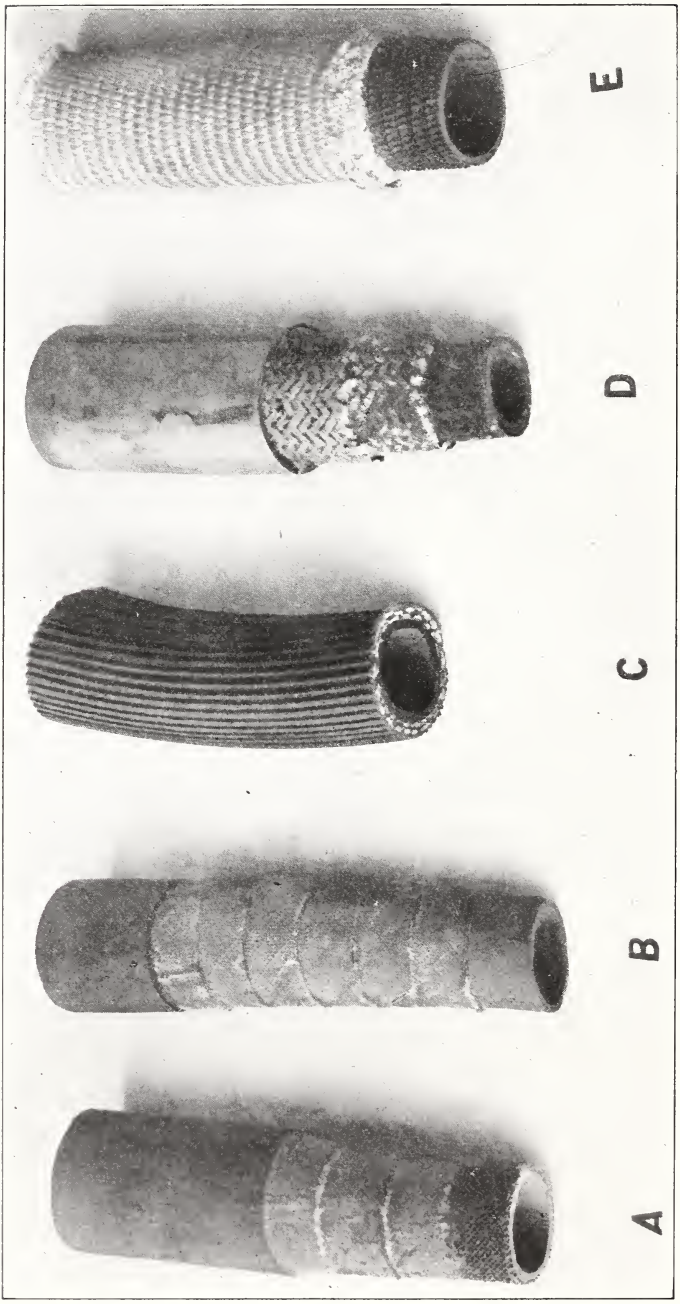

FIG. 1

die, after which it is cut into 50-foot lengths. The fabric is first impregnated with a rubber compound and then cut on the bias into sheets which are placed end to end and lapped, thus forming a strip the length of the hose and of sufficient width to produce the desired number of plies when wrapped around the tube. In fabricating the the hose the rubber tube is drawn over a smooth steel tube. The steel tube is then placed between three horizontal rollers which revolve and wrap the reinforcing fabric about the rubber tube. The rubber

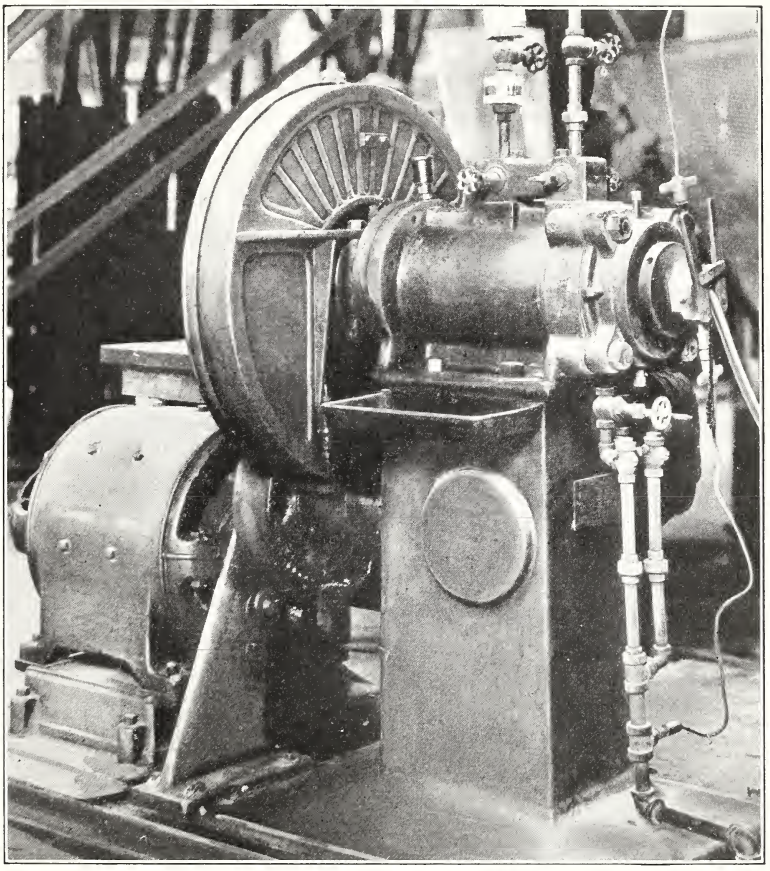

FIG. 2

cover in the form of a sheet is applied by a continuation of the same process. (See fig. 3.) The hose is then transferred to a wrapping machine in which it is wrapped tightly with a strip of fabric as the steel tube revolves about its axis. The object of this is to compress the body of the hose into a compact mass and to insure thorough adhesion between the rubber and fabric parts during the process of vulcanization. The hose is now placed in racks set on a carriage, and run into a long heater or chamber into which steam is admitted

under pressure. After vulcanization the wrapping is removed, leaving a distinct imprint of the fabric on the rubber cover, which is characteristic of this type of hose. Wrapped hose is sold in 25 and 50 foot lengths.

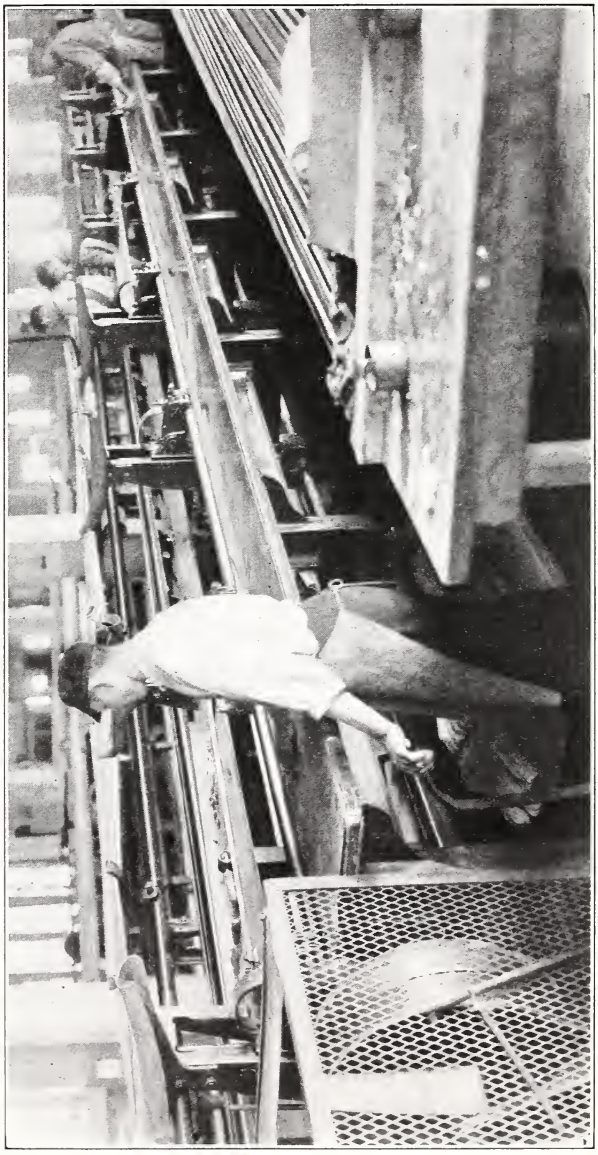

FIG. 3

2. BRAIDED HOSE

Braided hose consists of an inner rubber tube the same as wrapped hose, one or more plies of cotton braid, and a rubber cover. The tube is made in continuous lengths of about 500 feet by the extruding

process referred to above in connection with wrapped hose. A jacket of braided fabric is applied by passing the tube through a braiding machine (see fig. 4). Much of the cheaper garden hose has but one

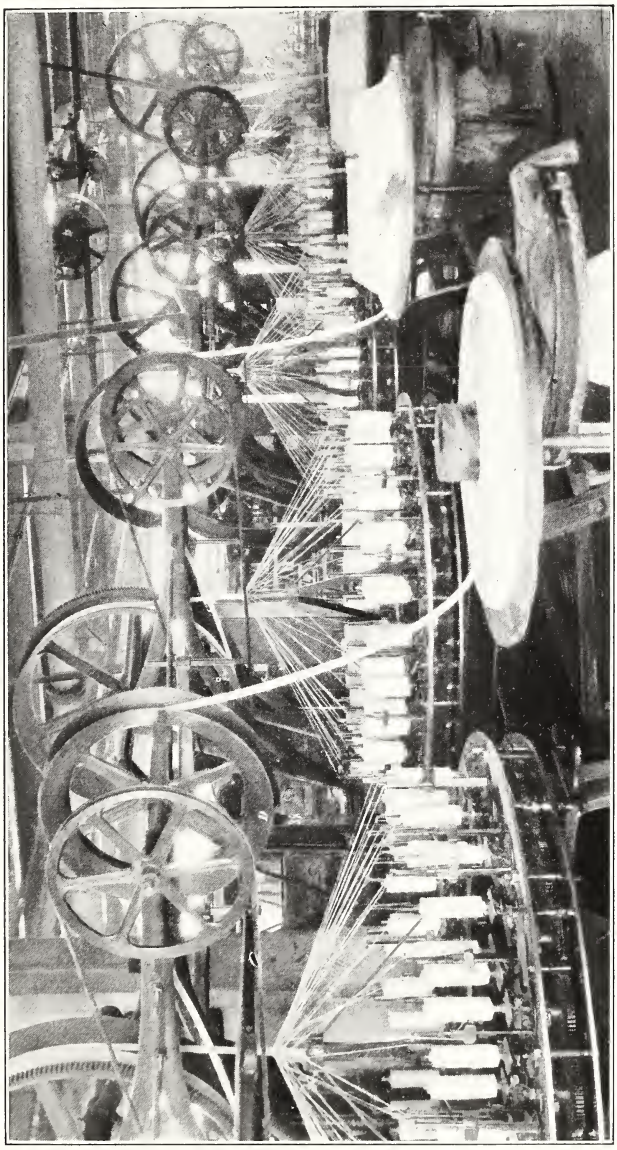

FIG. 4

of these braided jackets. When two jackets are required, the hose is passed a second time through the braiding machine, having first received a coat of rubber cement which serves as a bond between the two jackets. The rubber cover is then applied by passing the hose

through an extruding machine similar to the one used in making the tube for the inside of the hose.

Braided hose is vulcanized either in a mold or by an ingenious process of recent application known as the "lead press" or "lead jacketing" process.

When a mold is used, it consists of two steel plates containing grooves of semicircular cross section which, when placed face to face, form a continuous cavity into which the hose is placed for vulcanization. The plates are provided with internal channels or compartments for the circulation of steam, and the hose is expanded in the cavity of the mold by means of internal pressure. Molded hose may be recognized by two ridges which are caused by the joint between the two halves of the mold.

In the "lead press" process the hose when ready for vulcanization is incased by a lead jacket which is formed in an extruding machine. Molten lead is poured into a cylinder, and after it has solidified it is extruded through a die under heavy pressure. At the same time the hose is passed through the die and is carried along in the lead jacket which forms the curing mold. The lead-jacketed hose is now coiled on reels and vulcanized in a steam heater. During vulcanization the hose is subjected to internal pressure (usually water), which causes it to expand uniformly against the inside of the lead jacket. After vulcanization the lead jacket is stripped from the hose, which is then ready for the consumer. Braided hose is obtainable in lengths of 500 feet or less.

3. COTTON RUBBER-LINED HOSE

Garden hose of this type consists of an extruded rubber tube and a circular woven seamless cotton jacket. The jacket is woven separately in a continuous length and cut into lengths of 50 feet. A 50-foot length of tubing is drawn through the jacket, the ends are clamped over steam connections, and the hose filled with steam under pressure. This expands and compresses the tube, causing the rubber to adhere to the jacket and at the same time furnishes the heat for vulcanization. The hose is sold in 25 and 50 foot lengths.

III. SIMPLE METHODS OF INSPECTION AND TEST OF GARDEN HOSE

The purchaser of garden hose usually has no facilities for testing and can do little more than make a visual examination. A few suggestions are offered as a guide in making such an examination.

The resistance to kinking offered by a piece of hose may be determined by bending it slowly and observing how uniformly the hose takes the curvature. If, after bending a piece of hose to a curvature such as might be reasonably expected in service, the curvature

suddenly concentrates at one or two points, the hose is likely to give trouble as a result of kinking. The best hose can be bent into a

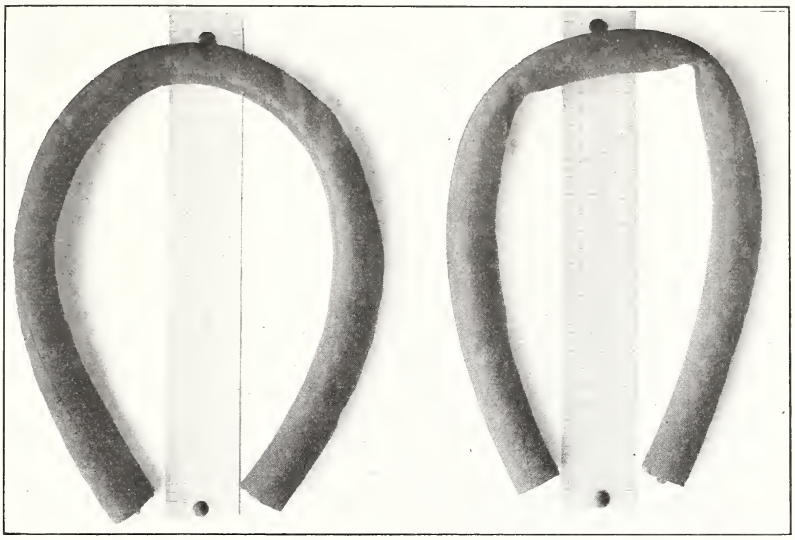

FIG. 5

curve of fairly small radius without "breaking" at any one point (see fig. 5). In cheaply made hose the rubber cover sometimes shows a total lack of adhesion in places. Such a condition is revealed by the bending test, as illustrated in Figure 6.

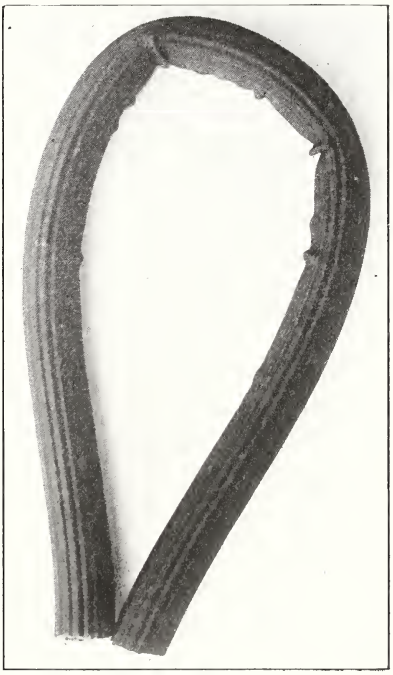

FIG. 6

Although hose offered for sale is usually coupled, making it impossible to examine the ends, the dealer in most cases has small samples of the same hose. An idea of the relative quality of rubber compounds may be formed by picking small pieces from tubes and covers with the thumb-nail. The better grades of compounds, by reason of their toughness, will be found to offer greater resistance to this picking operation.

If one cares to look further into the quality of the materials, he may observe the adhesion between the rubber and the fabric parts by the simple operation of cutting a

small ring section from the hose and pulling it to pieces; after which he may break small strips cut from tube and cover.

The thickness of tube and cover is not necessarily of any particular significance and may vary according to the nature of the rubber compound used. The function of the tube is primarily to provide a reasonably smooth waterway and to protect the fabric reinforcement. The cover has to resist abrasion as the hose is dragged about and also has to protect the fabric from the injurious effects of water. The use of corrugated hose covers (which are found only on braided hose) is of questionable advantage. It is sometimes claimed that a corrugated hose offers increased resistance to kinking, but it is doubtful if any appreciable effect of this sort is produced by the corrugations. On the other hand, however, if the corrugations are too deep or too sharp they sometimes shorten the life of the hose by causing the cover to crack at these corrugations.

The amount of cotton reinforcement may be estimated from the appearance of a cut section of the hose. Hose of wrapped construction contains about 3 plies of duck or from 5 to 7 plies of sheeting.

Braided hose with two cotton jackets, being stronger and more resistant to kinking, is preferable to hose having a single jacket.

Lack of uniformity in the wall thickness of hose, or what is commonly referred to as an "out-of-round" hole, is an indication of poor workmanship and possible weakness.

IV. SIZES AND DISCHARGE CAPACITIES OF GARDEN HOSE

Garden hose is made in several sizes, ranging from ½ to 1 inch, inside diameter. In recent years there has been a strong tendency on the part of manufacturers to encourage the use of ⅝-inch hose in place of the ½ and ¾ inch sizes. This standardization of size seems desirable for several reasons. It would tend to reduce the cost of manufacture by eliminating two sizes, and at the same time it would reduce the amount of stock to be carried by dealers.

The discharge capacity of a ⅝-inch hose would, of course, be considerably greater than that of an equal length of ½-inch hose, and of a ¾-inch hose considerably greater than that of a ⅝-inch hose if the hose alone were to be considered; that is, if the pressure at the inlet of the hose was the same in each case and the discharge outlet was the full diameter of the hose. The usual conditions under which garden hose is used are, however, quite different from those described above. The full supply line pressure is not available at the hose inlet, but the water usually flows through several feet of ½-inch pipe and a ½-inch faucet before reaching the hose; and also the water does not usually discharge directly from the open hose end but through a spray nozzle. The nozzle appears to be standard, with the same diameter of outlet for all three sizes, whether ½, ⅝, or ¾ inch. Under

these usual conditions the piping and faucet preceding the hose and the spray nozzle are factors which greatly modify the quantity of water which would be discharged from the different sizes of hose if the hose alone were the determining factor.

The results of tests made by this bureau to determine the rate of discharge at different pressures for ½, ⅝, and ¾ inch hose under what may be considered representative service conditions are shown on the following chart (fig. 7). In these tests the water in every case flowed through 15 feet of ½-inch pipe, counting from the point at which the pressure was measured, and a ½-inch faucet before reaching the hose, and through a spray nozzle with a $\frac{9}{32}$-inch opening

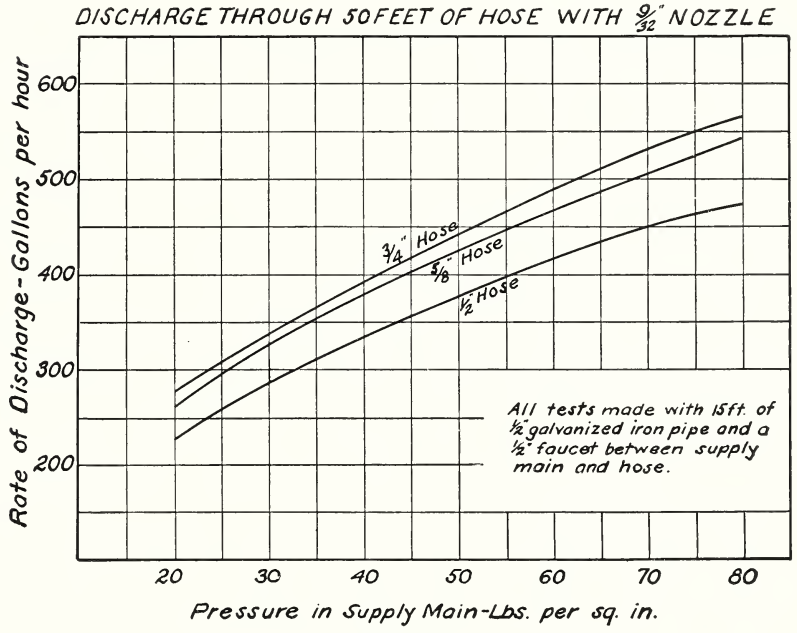

FIG. 7

after passing through the hose, which in all cases was 50 feet in length. The rate of discharge would vary from the values shown if the conditions were different from those in the tests, particularly if the faucet or spray nozzle were different than those used.

These data are merely presented to give an idea of the approximate rate of discharge to be expected from each size of hose and of the relative rate of discharge of the different hose sizes under usual service conditions. From these data it appears that under usual conditions of use the difference in rate of discharge is actually much less than might at first glance be expected and, considering the rather indefinite requirements of the usual purposes for which garden hose is used,

not very appreciable. It would, therefore, appear that practically the $\frac{5}{8}$-inch size hose would serve as a satisfactory substitute for the $\frac{1}{2}$ and $\frac{3}{4}$ inch sizes.

V. SELECTION OF GARDEN HOSE

In selecting garden hose consideration should be given to the inherent advantages and disadvantages of the different types and to the nature of the service required of the hose. If the conditions of service are not severe and the hose is needed only for a short time, a cheap hose of light construction may give satisfaction, otherwise it would be in the interest of economy to purchase hose of better quality and to take good care of it. Any claim for excellence of quality as indicated by a particular color should be discredited.

Wrapped hose will render satisfactory service if it is of good quality and if given reasonable care, particularly in the avoidance of kinking. The main difficulty with wrapped hose is that it is easily and seriously injured by kinking. Kinking causes the various plies of fabric to become separated and tends to produce breaks in the tube forming weak spots in the hose which in time develop into leaks. Long service is not to be expected of cheaply made grades of wrapped hose because the raw materials used in their manufacture are of inadequate strength to withstand the bending to which every garden hose is necessarily subjected. The cover stock of such hose provides but slight protection to the fabric reinforcement which, when exposed to the elements, develops ply separation in a short time.

Braided hose as a rule is less subject to injury by kinking than is wrapped hose, and it has the additional advantage of being available in lengths up to 500 feet.

Cotton rubber-lined garden hose of the usual commercial quality may be offered at an attractive price which might justify its selection for temporary use. An objection to this type of hose lies in the fact that its cotton jacket is exposed to the deteriorating effects of water and abrasion.

The qualities to be desired in garden hose, briefly stated, are as follows:

1. Strength to resist the internal working pressure with a reasonable factor of safety.
2. Ability to withstand bending without kinking.
3. Ability to resist abrasion.
4. Minimum rate of deterioration with age.

Information regarding items 1, 2, and 3 may be secured by inspection and test as previously described, but the aging properties of rubber (item 4) are not susceptible of determination by any simple means.

Obviously, the price asked for hose that embodies these qualities is usually not the lowest, but neither need it be the highest. As a matter of fact, price in itself should not be the deciding factor in the purchase of hose. The price paid for any commodity is significant only when considered in relation to the length and kind of service delivered.

VI. CARE OF GARDEN HOSE

There is, of course, a considerable difference in the quality of the various grades of garden hose, and the service rendered naturally varies accordingly. However, the user has a great deal to do with the length of service he will receive. Garden hose in many instances has been known to serve upwards of 10 seasons, whereas hose of best quality is sometimes rendered unfit for use in one or two seasons by careless usage. It is reasonable to expect from garden hose a measure of service commensurate with the value of material and labor used in its manufacture, but to accomplish this care must be exercised in using the hose, and it must receive proper treatment. The following directions for use and storage are offered in the interest of satisfactory service and long life of the hose.

Avoid bending the hose at a sharp angle. This applies particularly to the faucet end of the hose. The faucet should be mounted so that the hose hangs directly downward. In this connection it is recommended that hose of ample length be provided in order to avoid stretching it in an endeavor to reach the extreme portions of garden to be watered. Repeated sharp bending at the faucet will cause premature failure.

In moving the nozzle from place to place, as must be done frequently in watering a lawn of any size, the hose if allowed to form loops is easily kinked.

Dragging hose around sharp corners or rough obstacles, such as tree trunks, is injurious, and if it is brought in contact with sharp stones, broken glass, etc., it must suffer accordingly.

If it is necessary for the hose to lie across a driveway, it should be shielded from the crushing action of wheels.

Under no circumstances should the water pressure be left on the hose when not in use. Shut off the water at the faucet rather than at the nozzle, to avoid injury due to excessive internal pressure. This precaution is particularly important if the hose is of light construction.

Sunlight is very injurious to rubber. Therefore do not leave hose lying in the sun.

A hose reel, of which there are numerous kinds on the market, is the best simple means of protecting hose when not in use. Before

winding the hose onto the reel see that the nozzle is open in order that the water will run out as the hose is wound up.

It is bad practice to hang hose on a nail or any narrow support, particularly if it is to remain hanging for any length of time. Its weight causes it to sag at a sharp angle forming kinks which are most injurious.

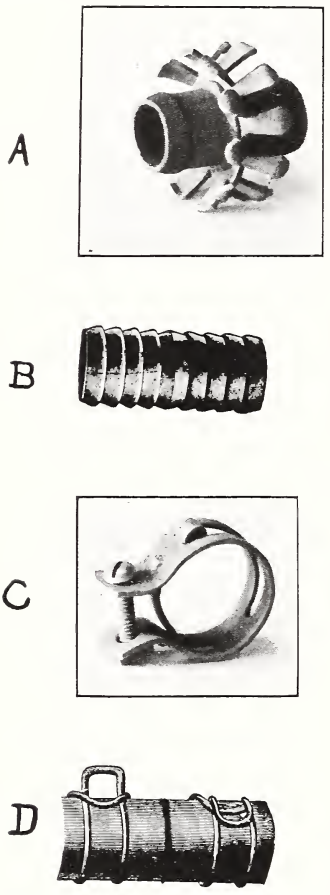

FIG. 8

When hose is stored for the winter, it should be first carefully drained and then put in a cool dark place, away from the furnace or other source of heat. If a reel is not available, the hose may be coiled and hung on a curved frame which approximately fits the inside of the coil. Otherwise the hose may be coiled on the basement floor.

The use of tape or other bandages to repair leaks is not recommended. The proper procedure is to cut out the defective portion and then rejoin it by means of a regular hose mender (see fig. 8). A proper and convenient commercial type is one which is closed with a hammer. Care should be taken not to force down the claws too tightly, as they may defeat their purpose by cutting the hose. Wire clamps or band clamps are also satisfactory.

In cutting out a leaky portion of the hose it is well to examine its ends with the view of ascertaining whether or not the defective portion has all been removed. It frequently happens that water breaks through the tube and then travels along the interior of the wall, finally coming through at the first weak place it finds in the outside of the hose.

In recoupling a piece of hose or in applying menders be careful not to injure the inside of the hose with the shank of the coupling or mender.

WASHINGTON, August 2, 1926.