TEXTILES: CARE AND TESTING

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What This Text Covers . . .

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Cleaning and Mending

Economics of Fabric Care

1. Textiles play an important part in the living expense of every one of us. A simple example will show why you should know about the proper care and testing of fabrics. Let's say Mrs. Smith has bought a pretty dress, made from one of the synthetic fibers. While admiring the nice fit, she didn't listen to the salesgirl—even if the salesgirl bothered to tell her how to care for the fabric.

Having worn the dress all day, Mrs. Smith notices a few slight wrinkles. She wants to look her best in the evening when Mr. Smith comes home. So—off goes the dress and she plugs in the iron, set at "cotton" from previous ironing. The hot iron touches the new dress, and the fabric melts into a sticky goo. You can imagine the rest of the story for yourself.

All this would not have happened: 1) if the textile manufacturer had given the proper information to the clothing manufacturer; 2) if the clothing manufacturer had given the information to the retailer; 3) and if the retailer had given the information to the customer. It is possible, of course, that this chain of information works without a snag, but chances are against it. The only safe thing for you to do is to learn the essential facts for yourself. You should learn about fabrics and fibers; not just the synthetics, but all fabrics. Then you should learn about dry cleaning and testing. We'll start with a study of dry cleaning.

National Institute of Cleaning and Dyeing

2. The American public spends over one billion dollars annually for dry-cleaning services. The processes used in dry-cleaning plants today are very technical. New fabrics, made of both natural fibers and synthetics, variations in fabric and garment construction, new dyes, finishes, and decorative designs must be considered. These conditions require constant research on the part of the dry-cleaning industry, to keep abreast of textile developments.

The care of clothing through dry cleaning requires a thorough knowledge of the effects of various solvents, soaps, chemicals, and in stain removal; of temperatures and pressures used in pressing; and of the reaction of dyestuffs, and so on. This research is conducted in the modern laboratories of the National Institute of Cleaning and Dyeing in Silver Spring, Maryland. The 7,500 dry-cleaning plant owners who hold membership are kept informed of the latest developments through regularly issued technical bulletins. The National Institute has collected much of the information you'll study here, and also furnished illustrations of dry cleaning for this instruction text.

General Cleaning Procedure

Receiving the Garments

3. From the time garments are received in a cleaning plant until they are ready for delivery to the customer, they pass through several departments. The customer gives the garments to the salesgirl behind the counter or to the routeman who calls at the home. These should be trained individuals who can talk intelligently on the problems involved in the cleaning of any particular garment or household textile.

When the garment is received, the salesperson should mark it for identification, and inspect it carefully. He should note any rips or tears, or unusual stains. He should try to recognize

fabric or garment constructions that may present a problem in cleaning. Of course, he can't be expected to be a detective or a mind reader. It is desirable that the customer inspect thoroughly the item brought in for cleaning, and give information to the salesgirl or routeman regarding unusual spots or stains, as well as any peculiar condition of the garment.

Marking the Garments

4. In the marking department, identification tags are placed on the garments. The garments are sorted according to type. First, the woolen and worsted garments are separated from silks and synthetics. Then each of these types is sorted according to white, light, or dark colors. Items that require special handling are separated from those cleaned by the regular procedures. Classification varies with the size of a plant. Some concerns may have as high as seventeen classifications of items according to fabric type.

Many plants remove accessories and clean them separately. Breakable articles such as buckles, buttons, and ornaments are removed and sent to the sewing department, where later they will be sewed on the cleaned and finished garment. Hooks and sharp metallic trimmings are covered so that they will not cause fabric damage. Pockets, cuffs, and seams are brushed to remove loose soil and lint. This operation will help to eliminate the possibility of shine or seam impressions. The brushing also removes loose soil and grime so that it will not be carried into the cleaning solvent.

Some plants make a practice of measuring all garments that come in for cleaning. This is time-consuming and increases the cost of operation. It should not be necessary if a standard practice of cleaning is followed. There are three types of work that must always be measured: 1) garments accepted for wet cleaning, 2) all knitted garments; and 3) items that are to be dyed. At this point it may be well to explain the difference between dry cleaning and wet cleaning. In dry cleaning,

chemical solvents, sometimes with added detergents, are used as the cleaning medium. In wet cleaning, water and detergents are used.

Dry-Cleaning Processes

5. Most garments and household textiles can be processed by fairly standardized methods. The specific sequence and method of processing depends upon the classification of items to be cleaned. The fundamental process for all items includes the immersion and agitation of the textile in solvent. The solvent will loosen the dirt, which is then flushed away by the movement.

There are two general classifications of dry-cleaning solvent: 1) petroleum solvent, and 2) synthetic, or chlorinated hydrocarbon, solvents. Among the petroleum products, some trade names are Renuzit, Stoddard solvent, and 140-F solvent. The synthetic solvents are composed of chemicals, such as perchloroethylene, carbon tetrachloride, and trichloroethylene. Dry cleaning of high quality may be done in any solvent, regardless of the type.

The garments are first placed in a dry-cleaning washer. This washer is similar, in principle, to a washing machine, but much larger. The garments are agitated in clean dry-cleaning solvent, to which special soaps or detergents have been added. This treatment removes all loose soil, and dissolves all oily and greasy soil. However, soil or stains that are water borne cannot be removed by dry-cleaning solvents. For this reason, soil, spots, or stains that have water as an integral part must be removed by either a pre-spotting or a pre-brushing treatment, or by spotting after cleaning. Many stains require special treatment before the dry-cleaning process. For example, grass stains, gutter splash, and paint stains should be removed before dry cleaning. We'll go into the problem of stain removal more deeply later. Let's first continue to follow the garments through general processing.

Solvent Treatment

6. In order to prevent loose soil from redepositing on the cleaned garments, the dirty solvent is drawn from the washer at the end of the run and replaced with clean solvent. Most dry-cleaning plants utilize a continuous-flow system. That is, the dry-cleaning solvent is continuously pumped out of the washer and through a filter that removes insoluble soil from the solvent; the clean solvent then flows back into the washer again. The solvent may be circulated continuously at a rate of 3,000 or more gallons per hour. Addition of filter aids such as diatomaceous earths, clays, and absorbent powders also helps to keep the solvent clean. A knowledge of the scientific principles related to dry cleaning is required to keep the solvent in good condition and thus insure maximum cleaning efficiency.

Dry-cleaning solvents are rather expensive; they cannot be discarded. In order to reclaim them, the cleaner must rely on filtration, distillation, or an extensive chemical treatment. Distillation assures a continuous supply of clean, colorless solvent so necessary for quality cleaning.

Upon completion of the cleaning and rinsing cycle, the garments are placed in an extractor, as shown in Fig. 1. This works just like a domestic spin dryer. It removes the solvent from the garments by centrifugal force. The extractor must be loaded as evenly as possible, so it will run smoothly at high speed.

The last traces of solvent are removed in a special piece of apparatus, a tumbler in which a carefully controlled current of warm fresh air is circulated through the garments. Some items, either because of their particular construction or because of their size or bulk, are deodorized most effectively by placing them in a drying cabinet. Here again, the warm fresh air is circulated through the fabric, thus removing any traces of solvent odors.

FIG. 1. EXTRACTOR

Spotting Operations

7. After the dry-cleaning and drying operations, the garments are sent to the spotting department. Spotting of garments requires skill and a special technique. A thorough understanding of textile fibers, fabric construction, dyestuffs, and chemicals is essential. The spotter is one of the highest-paid individuals in the plant. The operation is so important that it will be discussed later in great detail. Here, we'll only see what the duties of the spotter are.

Each garment that comes into the spotting department is an individual problem and must be treated as such. Here you have the problem of selecting the proper solvent, whether it be dry, wet, or semi-wet; the proper lubricant; and the particular chemical related to the particular problem at hand. The principal problem involved in spot and stain removal is not that of finding the particular reagent that will remove the stain; but rather it is the selection of a reagent that will remove the stain without resulting in damage to the fabric or dyestuff.

In some instances it is impossible to remove stains from a garment without running the risk of damaging the color of the dyestuff, the finish, or the fabric itself. In such instances the cleaner must know when to stop the spotting operation. It is better to return a garment to the customer with the spot remaining in the fabric, than to remove the dye along with the spot.

Wet Cleaning

8. Some garments may have become soiled to such an extent that immersion in a dry-cleaning solvent does not adequately remove the general grime and dirt. Wet cleaning is a process of cleansing such garments in water and water-soluble detergents. Laundry soap or synthetic wet-cleaning detergents can be used. In wet cleaning, you must observe precautions to prevent shrinkage, loss of color, and fabric distortion. The cleaning industry regards properly applied wet cleaning as a necessary part of plant procedure in restoring a garment to an acceptable condition when all other methods have failed.

Garments that are wet cleaned are first dry cleaned to remove all solvent-soluble soil. The dyestuffs are then tested for color fastness to the wet-cleaning process. Some garments may require digestion, or enzyme treatment, to remove the stained areas. The garment is then immersed in a solution of lukewarm water and synthetic detergent or neutral soap. As shown in Fig. 2, the garment is hand brushed on a specially

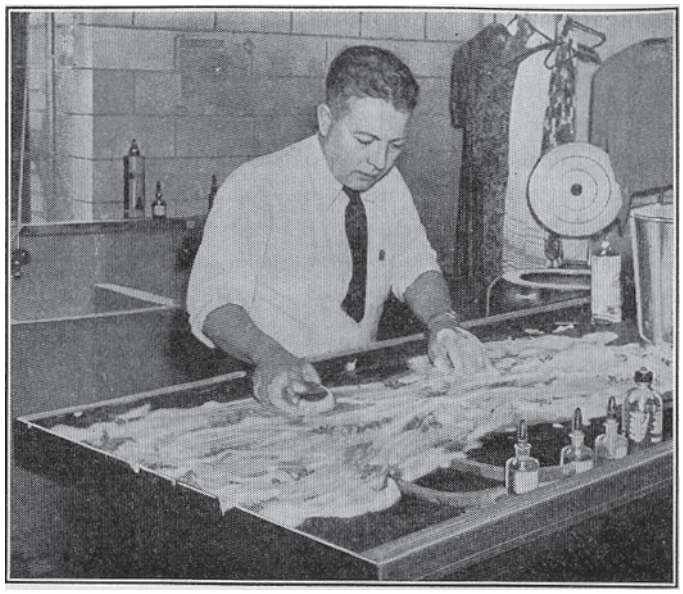


FIG. 2. WET CLEANING

built table. This mechanical action is a surface action that is less drastic than the mechanical action of a washing machine. Next the garment is given a series of rinses and the proper dye-setting or sizing treatment. Some white garments may require bleaching. The bleaching treatment is a slow, mild treatment utilizing mild bleaches at a low temperature for several hours. The treatment must not reduce the strength of the fabric or cause other fabric damage.

9. After wet cleaning, the excess water is removed from the garment by extraction. To facilitate the handling of garments that are wet cleaned, a special piece of equipment was designed, called a wind whip. The unit is heated to hasten drying and thus eliminate streaking and bleeding of dyestuffs. The air flow serves to remove wrinkles, which aids in the final finishing of the garment. Garments may be resized to original

measurements by an adjustable steam-air former. Trousers are shaped on trouser formers.

Many garments can be wet cleaned without loss of their original texture, color, or shape. However, even though precautions are taken and the garment is handled carefully, some fabrics shrink abnormally during wet cleaning, and often cannot be reshaped to their normal size. This is traceable to the construction of the particular fabric, failure to properly preshrink during manufacture, or overstretching of the fabric during manufacture in order to secure additional yardage. Also, if the dyestuff used to give the fabric its color or design cannot withstand moisture plus a dye-setting agent, or if the dyestuff has been applied improperly at the point of manufacture, the dyestuffs may bleed or change color during the wet-cleaning process. For this reason, many dry cleaners find it advisable to obtain the customer's permission before wet-cleaning a garment.

Garment Finishing

10. When garments are thoroughly clean and free from spots and stains, they are sent to the proper finishing department. The term finishing is used rather than the term pressing, because steam-air methods are used and pressure is not applied in the same manner as one thinks of pressing in a home operation. Quality finishing is dependent on a knowledge of the most effective ways of preserving and restoring the texture of the fabric and the shape of the garment. A great variety of equipment is available in a silk-finishing department. A specially designed piece of equipment, known as a bagsleever, consists of a bag over which a sleeve of a dress is drawn and which is then inflated with air and steam to bring the sleeve to its original shape.

Puff irons, which consist of perforated metal forms, padded and covered, and made in various sizes and shapes, are used to finish narrow frills, shirring, and darts, as well as the many

other complicated portions of the blouse or waist portion of a garment. Various types of presses are used, depending on fabric characteristics and garment construction. For example, a press with a polished head surface is used for finishing such smooth fabrics as satins and taffetas; a perforated head surface is used for dull-finished fabrics, such as crepes.

Some garments lend themselves to steam-air finishing. For this reason the industry has developed a unit utilizing steam and air for garment finishing. The steam-air finishing units may differ in size and shape. The principle involved utilizes steam to make the fabric pliable, and air to dry it to its original shape. There is no danger of altering the texture of the fabric, because no pressure is used in this method of finishing garments or household articles. Many garments are so constructed that they require hand finishing. Here again, skill and special techniques are required to produce a professionally finished garment.

Final Inspection

11. After the garment is finished, buttons, ornaments, and trimmings that were removed prior to dry cleaning are replaced. Minor rips, tears, broken seams, and ripped hemlines are repaired. The garment is then ready for a rigid final inspection before it is bagged or boxed for delivery. A quality job must meet the following specifications:

WOOL FINISHING

1. Man's Suit
   - *a.* Requirements of Man's Suit Coat:
     1) It should be free of wrinkles.
     2) Lapels should be firm and rolled at first button or button hole.
     3) Garment should be free of shine and seam impressions.
     4) If creases are required in sleeves, they should be firm and even in front and back. Special attention should be given to sleeves to make sure that there are no double creases.

5) Collar must be pressed firmly.
6) Garment should have no pocket flap or pocket lining impressions.
7) Sleeve head should be rolled softly.
8) Chest should be rounded and firm.
9) Lining should be ironed.

b. Requirements of Man's Vest:

1) It should be free of pocket impressions and shine.
2) It should be free of wrinkles.
3) Shape should be rounded and firm.
4) Lining should be ironed.

c. Requirements of Man's Trousers:

1) Creases should be firm and even.
   a) Front creases should come to about the second button from the bottom of the fly.
   b) Rear creases should be about 4 in. above the apex of the seat of the trousers.
2) They should be free of shine and seam impressions.
3) They should be free of pocket impressions.
4) They should be free of wrinkles.
5) Cuffs should be even.
6) Creases must not be unbalanced—trousers must lie flat on hanger.
7) They should not have gathers around suspender buttons.

2. Woman's Suit

a. Requirements of Woman's Skirt:

1) It must be free from wrinkles.
2) It must be free from shine and seam impressions.
3) It should be free from "leave off" marks.
4) Inside seams should be straightened out.
5) It should have rounded hip area.
   Pleated Skirts:
   a) Pleats must meet all the way down when so constructed.
   b) Straight and knife pleats must be firm and free from ripples.

b. Woman's Suit Coat (Jacket):

1) It must be free of shine and seam impressions.
2) It must have no pocket impressions.

3) Lining must be ironed.
4) Lapels should be firm and have no rippled effect.
5) Materials around buttons should not be gathered.
6) Sleeves should be rolled.
7) There should be no "leave off" marks at waistline or wrinkles in underarm area.

3. Long or Box-Type Coat

a. Man's Topcoat or Overcoat:

1) It should be free from wrinkles.
2) It should be free from shine and seam impressions.
3) It should be free from pocket impressions.
4) Sleeves should be rolled except when old creases are worn in.
5) There should be no seam impression of flap in opening (vent) in back.
6) Lapels should be rolled and firm.
7) There should be no gathering, or puckering of material around buttons.
8) Lining should be ironed.

b. Woman's Long Coat:

1) It should meet all the requirements of the man's coat, plus:
   a) Coat should retain form-fitting effect.
   b) Pleats should have soft creases rather than a flattened appearance.

SILK, SYNTHETIC, AND COTTON FINISHING

1. Women's Dresses

a. Woman's Plain Dress

1) Garment should be finished to retain its natural characteristics (satin—lustrous; crepe—dull finish; net and cottons—stiff).
2) Sleeves should be rolled unless old creases are worn in.
3) Seams and panels should hang straight.
4) All open tucks should be rolled, not creased.
5) Garment should be free from shine and seam impressions.
6) Garment should be free from pocket impressions.
7) Garment should be free from wrinkles.
8) Inside seams should be opened and flat.

b. Woman's Pleated Dress

1) Garment should meet all the requirements of a plain dress, plus:
   a) Pleats should meet all the way down when so constructed.
   b) Single or knife pleats should hang straight.
   c) Fabric under pleat should be free of impressions.
   d) Pleats should have no rippled effect.

2. Woman's Evening Dress

a. Net Evening Gown

1) Garment should have characteristic stiffness in net section.
2) Garment should be free from sizing rings.
3) Puffed sleeves should be firm and evenly sized.
4) Material under net part of bodice should be free from wrinkles.
5) Taffeta skirt should be free from shine and seam impressions.
6) Net part of skirt should be firm and evenly sized.
7) Gathers at waist should be rolled, not creased.

Special Problems in Dry Cleaning

Responsibility for Dry Cleaning

12. The maintenance of garments in an immaculate and well-shaped and well-draped condition is just as important as their original appearance. It is here that the dry-cleaning plant enters the picture. Dry cleaning assures cleanliness, as well as longer and more satisfying wear of garments. And it is here that annoyances, disappointments, and problems can arise both to the dry cleaner and his customers.

The responsibility for satisfactory wear of garments is fourfold. It rests on: 1) the manufacturer, who should take serviceability as well as style and novelty into consideration; 2) the retail merchant, who should stock fabrics and garments that will give lasting satisfaction; 3) the consumer, who should use discrimination when making a purchase and give reasonable care to garments; and 4) the dry cleaner, who should

follow the perfected cleaning processes that are at his command and keep abreast of developments in the textile industry.

You will find greater satisfaction in wearing apparel if you scrutinize them carefully at the time of purchase. Your knowledge of fibers, weaves, and finishes used on fabrics will help you understand why some fabrics just naturally shrink; why some weaves are liable to be distorted; why some seams fray; and why a finish or dressing may not be permanent. You may still want such fabrics for their beauty or novelty, but you will not be surprised when their serviceability proves limited.

13. The public should not be expected to limit its purchases to heavy-duty fabrics or to old-line staples. It is up to the cleaner to learn how to adapt his processes to the many new and fine fabrics developed by the textile industry. If possible, he should try to learn everything about them before people start wearing them. Sooner or later, the new fabrics will be sent to him for cleaning. So when a new fabric comes on the market, here are a few questions that the cleaner will have to know how to answer:

Will the solvents and spotting compounds needed to remove certain kinds of soil and stains damage the fabric? A spotting agent satisfactory on one fiber may be injurious to another, and so the suitability of common agents for a given fiber must be tested.

What effect will temperature and moisture have on the new fabric? These are important factors in finishing. There are definite but different temperatures at which silk, wool, rayon, nylon, cotton, and linen will scorch—even melt in the case of acetate and some other synthetic fibers. The temperatures used in finishing equipment must be well under the maximum.

How firmly will the dyes hold to the fabric? Most dyes are fast to all processes in a cleaning plant. A few, however, will change or bleed. Since approximately 95 per cent of the

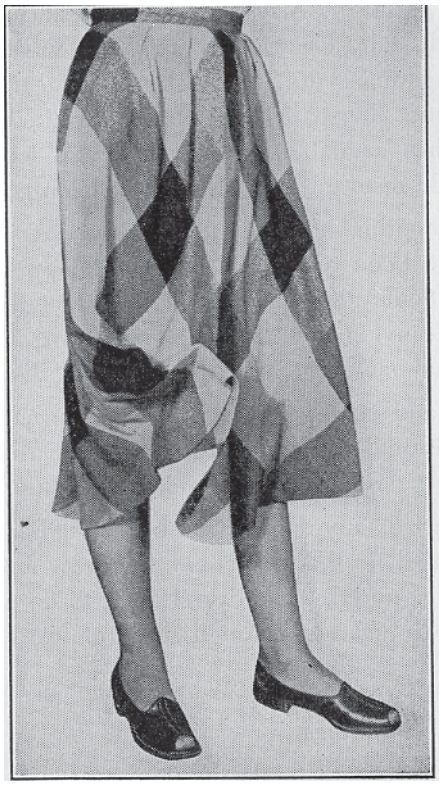


FIG. 3. EFFECT OF STATIC

garments that come into a cleaning plant are made of dyed fabrics, color fastness naturally is important in a new type of fabric.

Sizings and dressings may be a problem. Permanent sizings are used in many modern fabrics and are very satisfactory in most respects. However, there are stains that react with some of them and become extremely difficult to remove.

Special Finishes

14. Now let's look at some common problems. A particular difficulty is illustrated in Fig. 3. The wool skirt shown was

treated with a finish. After cleaning, the skirt gathered and held so much static electricity that it was unwearable. The tendency to gather static is very strong in fabrics made from some synthetic fibers. The producers of these fibers have special finishes available to overcome this tendency. The cleaner should restore the finish if it has been removed.

Another important item to check is flame-resistant finishes. If these have been removed, a garment may become quite dangerous. Some fibers, such as nylon, react to certain dyestuffs. While nylon normally does not burn, it can become highly flammable if it is dyed with the wrong dyestuff.

Raincoats and other outer garments are usually treated to be water resistant. If the waterproofing is of a nonpermanent type, it may be removed in cleaning and must be restored.

To summarize: any special finish should be preserved or restored. Labels in the garments often draw attention to the finish that is required. The dry cleaner, to do a good job, is well advised to make a thorough study of textile dyeing and finishing.

Fabrics and Trimmings

15. Of course, there is always the question of fabric construction. Is the weave fairly stable or will the yarns slip out of alignment? Are the yarns loosely or tightly twisted? Will the pile of velvet mat easily? If you do not know the answers, you should study these problems.

It is important that trimmings be dry cleanable. For example, an evening wrap might be made of a fabric that would dry clean beautifully; but if trimmed with imitation leather covered with cellophane, it could not be cleaned satisfactorily.

Fig. 4 shows a coat that was ruined because the dye of the button came off during steaming. Again, a garment may have decorative details made of sequins of two different materials. Although many sequins are made of a gelatine material that

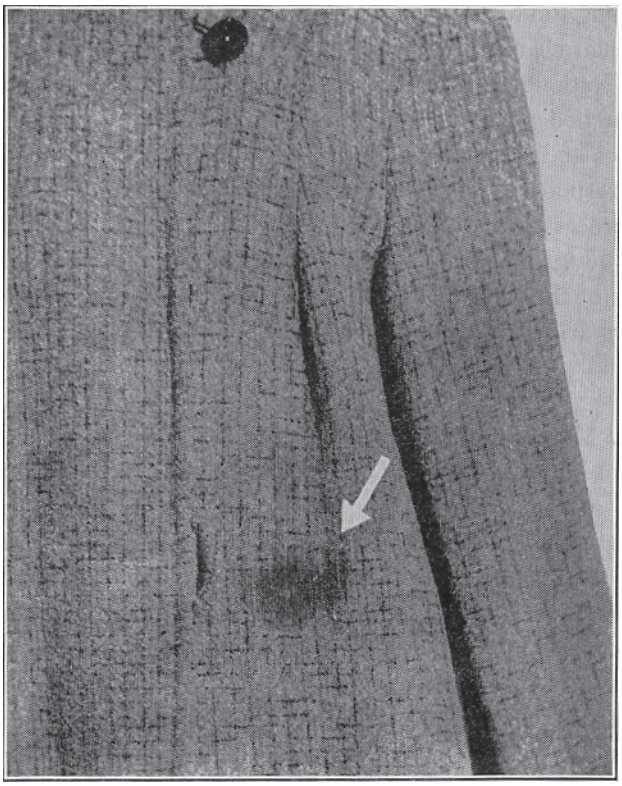


FIG. 4. FUGITIVE DYE ON BUTTON

will not withtsand water, the dry cleaner is aware of this and does not apply water to this type. Most sequins will withstand the normal dry-cleaning solvent. But one type material that will not withstand cleaning is made from a plastic, called polystyrene. This plastic softens or dissolves completely in dry-cleaning solvent. When it becomes softened and then dries, the plastic adheres to the fabric, resulting in a ruined garment. This plastic is also used in the making of some buttons.

The responsible cleaner is concerned about all these questions when he reads about a new fiber or new fabric that is

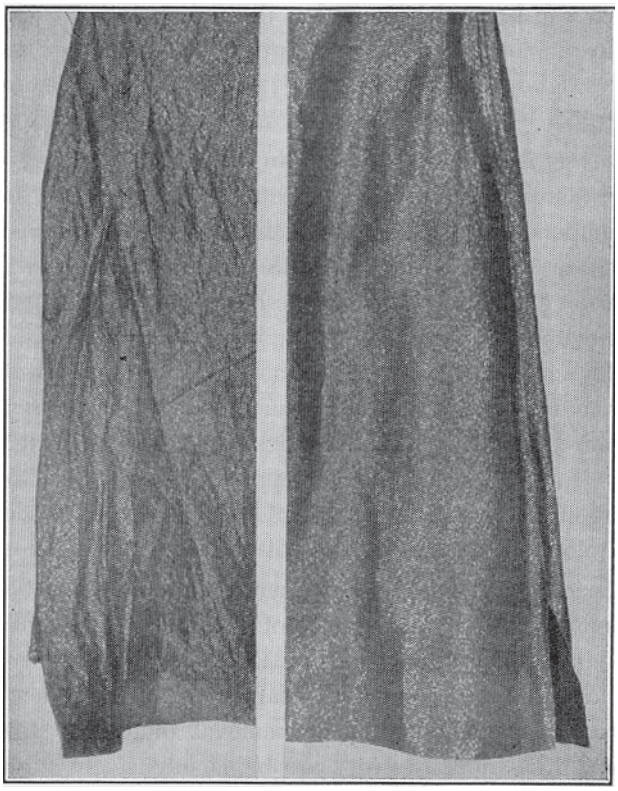
entering the textile field. Obviously it would be impracticable for each cleaner to conduct his own research on new fabrics. The National Institute of Cleaning and Dyeing maintains a research department that studies the properties of fibers and fabrics and advises member plants through technical bulletins. The responsible cleaner is willing to go a long way in adapting his processes to take care of new fabrics that his customers will buy. However, there are problems that defy solution. Some of these problems are inherent in the fabrics themselves; others arise from the way the garments are made.

Tarnish and Gas Fading

16. Metallic fabrics are quite a problem and many of them cannot be considered serviceable. As illustrated in Fig. 5 (*a*), some metallic fabrics wrinkle very badly and are difficult, if not impossible, to restore to a wearable condition. Even after careful pressing, the skirt that is shown in Fig. 5 (*b*) can hardly be regarded as an asset to the wearer. Many metallic fabrics are subject to tarnish from perspiration, from many stains, and merely from exposure to gases in the atmosphere about us. The skilled plant operator can sometimes remove tarnish or reduce it, but at best the improvement is only temporary.

There is a metallic yarn on the market made of an aluminum-base fiber laminated between two plies of vinyl plastic film. This type of metallic yarn will not tarnish. However, although this yarn does not tarnish, the fabric construction or the dyestuffs used to dye the fabrics may not always perform satisfactorily. Some types of fabrics have been printed with a gold or silver design to simulate the metallic fabrics. The performance of these fabrics is unpredictable.

A peculiar type of fading has been a problem to department stores, customers, and cleaners. It occurs on dyed acetate fabrics, and on some of the synthetics dyed with acetate dyes. It is known as fume fading or gas fading, and consists of a



(a) *(b)*

FIG. 5. EFFECT OF CLEANING ON UNSUITABLE METALLIC FABRIC

color change in which blue dye fades to a violet or reddish cast. It often occurs in streaks, particularly on the outside of sleeves or skirts.

The fading is caused by gases or smog in the atmosphere from the combustion processes in gas and electric stoves, fireplaces, furnaces, and other appliances in which coal, gas, or oil is used. The color change can occur on a new garment while it is still in the store, in your clothes closet, or during storage. All shades of blue are affected, as well as other colors in which blue is one of the dyestuffs. Research chemists are now working on the problem, and hope to find a solution.

All that can be said here is that the fading is not caused by dry cleaning.

Moire and Dressings

17. Here is a tip when purchasing a garment made of moire. Ask for assurance that it is an acetate or nylon moire; that is, the component fibers should be thermoplastic. If the fabric is rayon or silk, the watered or wood-grained design will disappear on contact with moisture. Hence, it will be impossible to remove any of that large group of stains that require moisture for efficient removal. If you happen to spill water or water-containing substances on a garment of either rayon or silk moire, you will note how quickly the design is lost in the area. However, a fabric development has appeared on the market utilizing a resin treatment to make the moire design more permanent on rayon and cotton fabrics.

Dressings and finishes are other treatments against which you must be on guard. Many of them disappear after one cleaning. Crease-proof and crease-resistant dressings may not endure beyond five or six cleanings. Some of them react peculiarly to stains and make removal difficult. However, textile finishes and dressings are being intensively studied in research laboratories; as a result, a number of satisfactory dry-cleaning products are now available. Also, even if the dressings are not permanent, the cleaner can replace some of them.

Properties of Adhesives

18. Adhesives are used in many ways in fabric and garment manufacture. It is the nature of some glues to dissolve in dry-cleaning solvents; and if one of these products is present in a garment in any form, you are faced with trouble. For instance, some manufacturer conceived the idea of making what looks like a satin-faced velvet ribbon. It really consists of two pieces of fabric glued together; a piece of velvet is glued to a piece of satin. The trimming has been widely used

on evening gowns and also on street dresses and children's clothes. Since the glue is soluble in dry cleaning, the ribbon will separate into its velvet and satin parts—and there you have a ruined garment, a dismayed cleaner, and a disappointed customer.

Look at the belt of practically any coat or dress you buy today, and you will see a composition reinforcement that looks a lot like leather. This reinforcement is affected by dry-cleaning solvents and also has a tendency to fray. Often the belt is innerlined with buckram that has been glued to the fabric; in dry cleaning, the glue or cement may come through to the right side and leave an ugly discoloration. The buckle itself is usually made of metal to which fabric is glued. It is very difficult, and often impossible, to do a satisfactory job on such belts; and after all, the belt is an important accessory to the garment. There are some manufacturers who make belts that will clean as well as the garment itself. If customers and store buyers would insist on cleanable belts, more manufacturers would realize that they have been making an unserviceable article, and the result would be all-round satisfaction.

Carefully examine pleated or fluted pockets. Many of the fancy designs are glued to a piece of fabric to hold the pleats or flutings in place. Some glues are soluble in dry-cleaning solvents, with the result that the pleats will fall out of place. Sometimes adhesives or a rubberized material is applied to eyelets to prevent fraying of the edges. Some of these are partially soluble in dry cleaning and a dark discoloration results. Solvent-soluble glue or cement is used in many imitation furs. If the cleaner does not detect the imitation, the result after dry cleaning will be an unsightly mess of cotton backing on one hand and yards of thick loose yarn on the other.

Several types of prints are produced by the use of adhesives. In one type, the adhesive is first applied to the desired design;

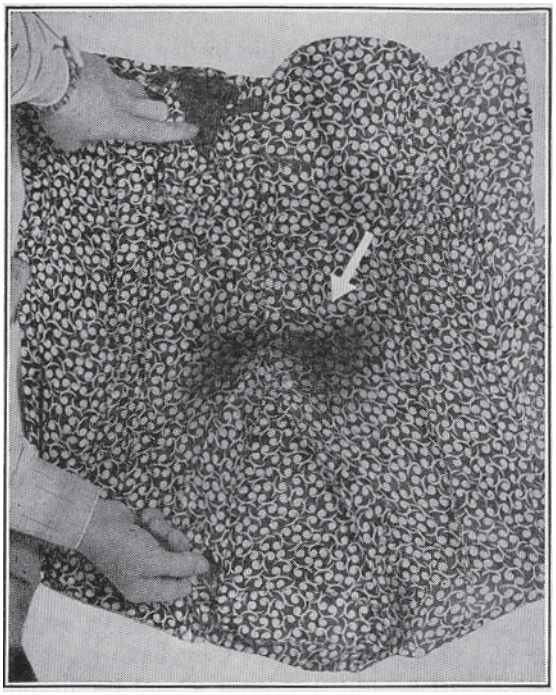


FIG. 6. SPOT CAUSED BY LINING

then finely pulverized fibers are blown into the fabric so that they adhere to the design. In another type, the dot or other design has a celluloid base. If a cool iron is used to avoid damage to the celluloid in the print, the wrinkles cannot be removed from the garment. If the temperature of the iron is raised, it may start to melt the celluloid.

Seams and Linings

19. In ready-to-wear garments watch out for shallow seams in velvets or in loosely woven fabrics that fray easily. The splitting of such seams can occur while it is being worn or during dry cleaning. Needless to say, it is most annoying to find that a seam has frayed to the stitching and then pulled

apart; however, this can be avoided by more critical purchasing.

Another point in faulty manufacture is the use of black buckram and lining materials for stiffening the tops of sleeves or reinforcing facings. When the black dye used in some of these fabrics is wet, it bleeds freely. If moisture is necessary to remove a spot or stain, it may penetrate to the black material and cause bleeding of the dyestuff as shown in Fig. 6. Moisture is also essential to finishing, whether it is done with an iron or a press. When steam used in finishing strikes the fabric, the black dyestuff will bleed onto the garment. The ugly discoloration from the bleeding dyestuff usually clings tenaciously to the fabric of the garment. The difficult point for both the customer during purchase, and for the cleaner, is that these interlinings are usually covered with the same fabric used in the garment itself, and thus are difficult to detect.

Hazards in Dry Cleaning

20. The basis of all dry cleaning, whether in the home or in the cleaning plant, is the solvent. There are two general types of cleaning solvents—one with a petroleum base, the other chlorinated hydrocarbons, commonly spoken of as a synthetic solvent.

The petroleum solvents include gasoline, and a number of naphthas or benzines, as well as Stoddard solvent, which is a petroleum solvent refined to meet specific needs of the dry cleaner. The hazards in using these solvents have been set forth in many pamphlets issued by the National Fire Protection Association. We quote the following from one of them:

A spark as tiny as that made by rubbing a cat's back is all that is needed to set off the vapor from gasoline used as a cleaner. Gasoline and similar cleaners evaporate readily and the fumes find their way to open flames or fires, explode, and cause frequent deaths and serious injury. The spark of static or frictional electricity, caused by rubbing the cat's fur, may similarly be caused by rubbing two

pieces of fabric together. Friction between any two objects, themselves nonconductors of electricity, causes electrical charges to form in each object. When the charges are big enough, a spark passes from the one object to the other.

When removing a spot with gasoline, a small piece of cloth is saturated with the liquid and rubbed on the spot. When the friction charges the two pieces of fabric, a spark and explosion or fire is the result. When there is more than 55 per cent of humidity in the air, the moisture acts as a conductor between the clothes, carrying off charges as they form and thus preventing static sparks. In commercial dry-cleaning plants, hygrometers are used to measure the amount of moisture in the air, moisture being added artificially when the humidity falls below 60 per cent.

But consider the housewife, using gasoline in her kitchen. How is she to know whether there is 55 per cent of humidity in the air or not? How is she to know that gasoline vapor will not find its way to the fire in the kitchen stove, or be ignited by some casual flame? She cannot tell when conditions may be just right for an explosion. That is why gasoline and other flammable cleaners are so treacherous, and why home dry cleaning is such a dangerous business. The latent destructive power of a pint of gasoline has been likened to a pound of dynamite. To bring either of these treacherous substances into the home is as unnecessary as it is foolish.

21. One of the valuable features of Stoddard solvent is the lessening of the explosion hazard by the specification that it must not flash below 100 F (Fahrenheit). In addition to using this safety solvent, cleaning plants observe many other precautions to prevent explosions and fires. For example, their power equipment is operated by explosion-proof switches and explosion-proof motors. Smoking is never permitted. Proper ventilation is strictly observed. In many states, workers are not permitted to wear shoes with hobnails if the floors are of concrete or other material on which static sparks may be generated.

The synthetic solvents include carbon tetrachloride, perchloroethylene and trichloroethylene. These are nonflammable and thus present no fire hazard. Carbon tetrachloride, how-

ever, is definitely toxic and escaping fumes may cause illness. Perchloroethylene is the least toxic of these solvents, but it is also quite expensive. Trichloroethylene is less toxic than carbon tetrachloride, but it has a tendency to bleed some of the commonly used dyestuffs. The synthetic solvents are very volatile, and cleaning plants that employ the type of equipment especially designed for their use observe every precaution to prevent evaporation of the solvent, both to protect the health of the workers and to reduce the expense caused by loss of the solvent.

22. The cleaning of the garments in the home with either petroleum solvents or chlorinated hydrocarbon solvents is not recommended because of the hazards involved. Petroleum solvents with a high flash point, similar to those used in the dry-cleaning industry, are available to the consumer, but these solvents are flammable and require special precautions in their use. Even in dry-cleaning plants where special equipment is available and every safeguard is employed to prevent fires, solvent is not permitted to be stored in open containers. In the home a pilot light or open flame, or friction from rubbing, can cause the solvent to ignite and result in a bad fire or explosion. The chlorinated hydrocarbon solvents, on the other hand, while not flammable, are quite toxic in nature. Numerous cases are on record where home users of this solvent have been overcome by the fumes produced, and sometimes the fumes have proved fatal.

There is another group of home dry-cleaning products that may be made of a mixture of petroleum and synthetic solvent, such as a mixture of carbon tetrachloride and toluene. In products like these, the synthetic solvent evaporates more quickly during use than the petroleum solvents, leaving a concentrated petroleum product. Such products, for safety reasons, should not be purchased in greater quantities than a pint.

It is poor economy for the housewife to try to save the comparatively small cost of having a garment cleaned by a professional cleaner, at the risk of causing a serious accident. If, however, dry cleaning at home is attempted, the following precautions should be observed: 1) The cleaning should be done in the open to prevent the accumulation of fumes, and away from any flame or pilot light. 2) The garment should not be rubbed, but merely dipped and squeezed out gently in order to prevent the creation of any friction. 3) The garment should be hung in the open to dry.

Dipping in solvent will remove only oily and greasy spots. It will not remove nonoily spots and stains. These are removed in the cleaning plant by an operator known as the spotter.

Mildew Prevention

23. In laundries and dry-cleaning establishments, in hospitals and hotels—in any circumstances, in fact, where textiles are stored damp—mildew is a great danger. Generally speaking, mildew is a parasitic fungi, or mold, found on foodstuffs, textile fabrics, and garments; it is caused by dampness or staleness. There are three main organisms which cause the formation of stained or rotted areas in a garment—Aspergillus Niger, Metarrhizium Glutonosium, and Chaetomium Globossum.

Examination of fabrics and garments affected by mildew is of benefit if you are interested in the subject, since it leads to remedies for the prevention of mildew in garments. In the laundry industry, mildew control is for the staining type of mildew fungus rather than for the rotting type. Mildew, or mold, has appeared at some time or other in practically every household. Certain restraining chemical compounds, called inhibitors, are used to prevent the formation of mildew. The major types include mercurials, phenols, and quaternary ammonium salts. Let's see how these chemicals compare with each other.

Mercurials are compounds which will prevent the formation of mildew. They will inhibit the growth of ammonia-forming bacteria. They are corrosive in nature, however, and they may cause skin burns if not properly applied.

Phenols include pentachlorophenol, which is used extensively in the textile and garment industries for mildew proofing. Ultraviolet light may attack the fabric treated with pentachlorophenol, because it has the effect of releasing hydrochloric acid, thereby causing tenderness to the material. Phenols are considered to be irritants at a strength of over 1 per cent following impregnation of the fabric. They are toxic when handled in the dry state, and great care must be used to prevent injury to the person who prepares the solution. Orthophenylphenol is used when starch is the sizing agent; the addition of this compound to the stock solution will prevent souring of the solution during hot, humid weather. Remember that mercurials and phenols are toxic and can cause skin irritations unless you use them under the proper conditions.

Quaternary ammonium salts seem the best to use for mildew proofing, since they are nontoxic, nonirritating, and noncorrosive. They are surface-acting agents; in addition, they belong in the cationic group, which possesses definite inhibitive properties on molds.

All of these chemical compounds are used to combat fungus growth in textile materials.

The microscope will be of great value to you. Through the use of this instrument, you can learn about bacteria, fungus, and mold. Its use will reveal much with regard to the many types of basic raw materials used to make textile fabrics. A close examination of specimens will reveal the effect of mildew on materials affected by parasitic fungi. A further study of the effects of mercurials, phenols, and quaternary ammonium salts should prove valuable.

Stain Removal

Action of Chemicals

24. As we shall see, many different methods are used to remove stains from textiles. Before going into these methods, it will be well to review carefully the action of various chemicals when brought into contact with textile fabrics.

The first group of chemicals we will consider are the acids. There are two classes of acids, the mineral and the organic. The first group includes such acids as sulfuric, hydrochloric, and nitric. The second group includes such acids as formic, acetic, tartaric, and oxalic.

Strong acids completely destroy most fibers; therefore they should not be used full strength on textile materials. Under proper conditions the dilute mineral acids may be used. The organic acids are much milder in their action, and are generally used where an acid treatment is necessary. Inorganic, or mineral, acids do not contain the element carbon.

Acids and Alkalis

25. Animal fibers are more resistant to the action of acids than are the vegetable fibers and rayon. Dilute mineral acid may be dried on wool at a high temperature without any harmful effects. This is the action employed in the carbonizing process whereby vegetable matter is reduced to carbon and removed from the wool. Nitric acid is not used much on animal fibers because it stains them yellow. Hydrochloric acid or sulfuric acid may be used on wool without harm if in dilute form and if properly handled. Since organic acids are milder than mineral acids, the organic acids are used a great deal on the animal fibers.

The vegetable fibers and rayon are readily attacked and destroyed by mineral acids. Even dilute solutions may cause

damage. In the drying, the acid gradually becomes more concentrated because of the evaporation of water; finally, the acid becomes strong enough to disintegrate the fiber. The organic acids, on the other hand, can be used on vegetable fibers even in fairly strong concentrations without any harmful action resulting. However, the nonvolatile organic acids, such as oxalic acid, will cause tendering if allowed to dry on the vegetable fibers at high temperatures. Note, also, that nylon will be dissolved by formic acid. When acids are used they should be rinsed off the material, then neutralized and rinsed again three or four times. Acids are neutralized by the use of an alkaline, or basic, substance.

The reaction of animal fibers to the action of alkalis is just the opposite of their reaction to acids. Vegetable fibers will even withstand boiling in alkaline solutions, but wool and animal fibers, which are quite resistant even to mineral acids, are completely decomposed by dilute solutions of alkalis. Sodium hydroxide, or lye, is a strong base and should not be used even in dilute concentrations on animal fibers. Other milder alkalis include ammonium hydroxide, sodium carbonate, trisodium phosphate, and some soaps. If vegetable fibers are boiled in alkaline solutions, the material must be kept below the surface of the liquid because the alkaline solution and the oxygen of the air cause a tendering of the fiber.

Bleaching Agents and Solvents

26. Bleaching agents are chemical compounds which destroy color and leave the material white. The important bleaching chemicals are 1) sodium hypochlorite, 2) hydrogen peroxide, 3) sodium perborate, and 4) potassium permanganate. All except the first one may be used on animal fibers. The other fibers may be treated with any of these bleaches. Sodium hypochlorite will turn animal fibers yellow; and if concentrated enough and used for a sufficient length of time, it will actually destroy these fibers.

Organic solvents are a very important group of chemicals used in spot and stain removal. Before using a solvent, you should determine its action on the fiber. In attempting to remove dye or ink stains from textile materials, remember the following points: 1) Dyes are fixed on animal fibers by using high temperatures and an acid condition. 2) Acid will keep the dyestuff from impregnating vegetable fibers. 3) Acetate is dyed with a special class of dyestuffs. 4) In working on a dye stain on woolen goods, the treatment should be cold and on the alkaline side, with soap for example.

Water is the universal solvent that is used most on textiles. Vegetable fibers become stronger when wet; animal fibers and most man-man fibers become weaker, but their original strength returns on drying. If rayon is treated in boiling water, its luster is affected. Acetate, if treated in hot alkaline solutions, becomes saponified; that is, it changes from cellulose acetate to regenerated cellulose. This change results in an alteration of the chemical properties and the dyeing properties, and in a loss of weight of the fiber.

Summary of Chemicals

27. Because of the vital importance of the relations between fibers and chemicals, let's briefly state those relations again in a summary so that you can memorize them.

1. Animal fibers withstand the action of dilute mineral acids, but are destroyed even by dilute alkaline.
2. Vegetable fibers will withstand alkaline treatment but not an acid treatment. Organic acids, which are milder, should be used wherever possible.
3. All the common bleaching agents can be used on the vegetable fibers, but chlorine bleaches cannot be applied to the animal fibers.
4. Certain organic solvents, such as acetone, will dissolve acetate, but they will have no effect on rayon or the natural fibers.

5. Water will weaken animal fibers and rayon, but it will add strength to the vegetable fibers.
6. Formic acid will completely dissolve nylon but has no effect on dacron. Orlon resists most acids and alkalis. Dacron may be harmed by warm phenol.

Principles of Stain Removal

28. A stain is discolorization produced by the presence or action of some foreign matter on the material. For example, grease causes a stain by its presence. If the grease on the goods is dissolved, the stain will disappear. Acid, however, causes a chemical action which may change the appearance of the material. Acid stains may be difficult to remove, since the fiber itself is affected, or the color on the fiber is destroyed.

Treat stains as soon as possible. The longer you let them remain on the goods, the more difficult it will be to remove them. If an acid stain is not cared for immediately, the chemical action will continue until the fiber is completely destroyed. Ironing will set certain stains, such as those produced by inks or dyes. The action of soap in laundering will make an iron stain more pronounced.

There are three major types of materials you can use in the removal of stains: 1) absorbents, 2) solvents, and 3) bleaches. The action of absorbents is comparable with that which occurs when using a blotter to take up ink. Solvents dissolve the staining substances, and the solutions formed are removed from the goods. Bleaches are chemicals which change colored substances to white. Watch out when you use bleaches on colored materials. The color itself may be affected.

29. Before you work on a stain, you should know what the stain is: the treatment depends upon the nature of the stain. The treatment given for one type of stain may fix another type. For example, an alkaline substance would be used to neutralize an acid stain, but the same treatment would make an iron stain more pronounced.

In the identification of stains it is necessary to consider such items as appearance, odor, color, and feel, and the occupation of the owner of the stained fabric. For example, liquor, perfume, medicine, and tar have characteristic odors. Tar, iodine, and lipstick have a distinct color. Gum, blood, and nail polish may be identified by their feel. Mud and perspiration usually appear on just certain parts of a garment.

After the nature of a stain is known, you must determine which fiber or fibers are present. You can start by burning a few strands of yarn taken from a seam in the garment. Test both the warp and the filling yarns, because many fabrics consist of more than one type or kind of fiber. If necessary, a chemical or a microscopical test should be made.

After the treatment has been decided upon, from the nature of the stain and the fiber content present, test the effect of the stain remover on some unseen portion of the material. This will show you whether or not the color of the material is altered. The stain remover may cause more of a discoloration on the material than the staining substance itself.

Types of Stains

30. Stains may be divided into two groups, 1) build-up and 2) absorbed. A built-up stain is mostly on the surface, such as a gum, food, or blood. The absorbed stain penetrates into the material between the interlacings or interloopings of the yarns, and even gets into the fibers themselves. Built-up stains are easier to remove. Simple methods are employed, such as brushing or scraping.

The absorbed stain must first of all be loosend from the cloth by solvent action, and then it must be taken out of the material by proper treatment. Some absorbed stains do not respond to solvent action directly. These are treated with chemicals that change the insoluble staining substances into soluble forms, which are then removed by the use of a solvent. Some stains cannot be removed at all, but can be bleached.

In the use of a bleach, the colored substances are converted to colorless compounds; and in that way the stain is made invisible.

How to Use Solvents

31. Many stains are removed by solvent action. Water will dissolve more substances than any other chemical. If you remember this fact, you can save on costly chemicals. Also, the material may not have to be exposed to harmful chemical action. Water, however, cannot always be used, since it may not have the desired action on the stain, or it may harm the color or finish of the fabric.

When you use a solvent, place the material on a flat surface with the stained side down. The reason for this position is that the stain should come out of the material from the same side it entered. Put a piece of absorbent cloth or a blotter under the stain. Sponge the stain with a cloth that is wet with the solvent. Don't use too much solvent—the stain may have a tendency to spread. Change the absorbent material when it becomes stained, or the fabric will be stained again. Stroke the spot toward its center with the solvent-saturated cloth so that the stain does not spread.

When the stain is removed, absorb the excess liquid in the fabric with a cloth or sponge. Then dampen the same area with a cloth pad moistened with the solvent. The dampening should be done in such a way that the center of the stained area contains the most solvent, with a gradual reduction of solvent toward the dry, outside edges. This is done so that the material will not show rings around the cleaned spot when it is dry. The rings are caused by the migration of sizing and finishing materials to the parts of the goods which dry last. If the area around the spot contains more liquid, it will dry last; sizing will accumulate in that area and a ring is sure to result. Quick drying tends to prevent the formation of rings, since it does not give the sizing compound an opportunity to

migrate. To remove the rings, wet the material once more, and try to have the sizing distributed more evenly. If you scrape the dry ring gently, enough of the excess sizing may be removed to overcome the defect.

Chemicals, Absorbents, Detergents, Enzymes, and Lubricants

32. A stain which is not removed by solvent action must be treated chemically. In this way the staining substance is changed to a new substance which is removed by solvent action, or the colored staining substance is converted to a colorless compound. With this type of treatment there is more danger of damage being done to the fiber or the color. You should make preliminary tests to determine the effect of the chemical on the material at hand.

Place the material on a flat surface with the stained side up. Moisten the spot with water. Use a pad of cloth or a blotter under the stain to pick up the excess chemical solution. Apply the chemical carefully, a little at a time, with a round glass rod. After giving the chemical a short time to act, neutralize it with another solution. For example, an alkali would be neutralized by an acid, and vice versa. You had better use a number of short chemical treatments followed by neutralizing and rinsing, rather than one long exposure of the stain to the action of the chemical.

After the stain has been removed, take the usual precautions against rings. The chemical method of stain removal is the only one suitable for certain stains. It will usually give rapid results, but the danger to the fiber and color is greater.

33. Certain solid substances, such as chalk and fuller's earth, can absorb staining materials from fabrics. Wet the stain, and keep it moist with water if it is dried out. Place the fabric on a flat surface with the stained side up. Sprinkle a layer of the absorbent on the stain and work it over until it is saturated. Then brush the absorbent off and put on a new layer. Repeat

the operation until no more of the stain comes out. A final long treatment, overnight for example, is often beneficial. Absorbents are not harmful to fiber or color. They are, however, slow in their action and usually must be followed by another treatment to remove the last traces of the stain.

In addition to solvents, absorbents, and chemicals, a detergent such as soap solution is often used. Its cleansing or purifying action will remove certain types of stains from fabrics. This can be accomplished by washing the entire fabric or garment, or by sponging the affected area. Ring prevention entails a final rinsing with water, since soap solution acts in a manner which dissolves certain impurities and carries along other insoluble particles in a colloidal form.

34. Digestion is another method used to remove stains. The action of digestion is similar to that occurring in the bodies of animals, in which insoluble foods are made soluble by the action of certain substances present in the body. For example, insoluble starch is converted to sugar by the action of enzymes. In the same manner insoluble protein foods are made soluble so that they can be absorbed by the body.

To remove stains by the enzyme method, sprinkle some of the digesting agent on the warm, moist stain. In a short time the insoluble food or other protein stain becomes soluble and can easily be washed out with water. In order for the action to take place, the spot must be neutral, warm, and moist.

The lubrication method is used to remove stains produced by insoluble substances such as lipstick, carbon, and insoluble pigments. Rub a lubricant such as glycerine or a colorless grease on the stained area. Then use a solvent to remove the lubricant, which carries the stain along with it.

To help fix in your mind some of the major methods of removing stains, you may want to experiment with them. To see how absorbent action works, pour colored solution into a beaker. Place blotting paper in the beaker and note the result.

To demonstrate solvent action, place dye powder in a beaker. Add a little water. Note what the water does to the dye. To demonstrate bleaching action, make a spot on white paper by dropping ink on it. Then treat with ink eradicator. Note what happens.

Practice in Stain Removal

35. It is obviously impossible to remember everything there is to know about textiles. As long as you know where to find the information, there is no point in learning all of it by heart. The housewife, the garment worker, or the spinning mill technician, for example, have little use for detailed know-how about operation of a dobby loom. But it is different with stain removal. Just think of a day in the average home. You'll encounter stains and spots from axle grease, grass, coffee, blueberry pie, and many other causes. If you know how to take care of them as soon as possible, you can save many garments from being spoiled beyond the point where it is possible to restore them completely.

You should therefore practice by answering questions such as the ones that follow, and by doing work in spot removal until you have mastered the various methods used. Even if you never make professional use of what you learn, it will come in very handy in everyday life.

By answering the following questions you will increase your mastery of the solvent method. Try to answer the questions, then check your answers at the end of the text.

1. What tests would you make before using a solvent directly on a stain?
2. Why should the stained side of the fabric be "down"?
3. Why should some absorbent material be placed under the stain?
4. Why should the sponging cloth, wet with the solvent, be squeezed out before using it on the stain?
5. Why should you stroke the fabric toward the center of the stain while removing the stain?

6. After treating the stain, why should the excess solvent be absorbed?
7. Why should the cleaned area be rubbed with solvent-dampened cloth, in strokes away from the center of the spot?
8. Why is it necessary to dry material quickly?

For practice, stain a piece of white fabric with grease. Then remove the spot with some grease solvent, using the procedure previously outlined. Also stain other materials and treat them with suitable solvents. Make certain to follow directions carefully. Keep in mind the type of fibers in the cloth: animal, vegetable, man-made, or a blend.

36. By answering the following questions, you will increase your mastery of the chemical method.

1. When are chemicals used in removing stains?
2. What precautions should you take when using chemicals?
3. Why should the stain be wetted prior to application of the chemical?
4. Why are several short treatments better than one long treatment?
5. What must be done to the chemical which is still on the material after the stain has been removed?
6. What would you do to remove rings which may appear after the stain has been completely removed?

For practice in the chemical method, stain a piece of cloth with iodine. Treat the cloth with sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$. (In the trade this compound is referred to as hypo; it is nonchlorine.) Then dissolve the hypo with water and note results.

By answering the following questions you will increase your mastery of the absorbent method.

7. Why must the stain to be removed by an absorbent be moistened if the affected area is dry?
8. Why is the absorbent "worked over" the stain?
9. Why is it well to use one long final application of absorbent?

For practice in the absorbent method stain a piece of material with oil. Sprinkle the stain with fuller's earth or French

chalk. Work the absorbent on the stained area. Brush off the absorbent; repeat the operation.

Acid, Alkali, Blood, and Chewing Gum

37. Having dealt with the various stain removal methods in general, we will now deal with various stains in an individual manner. All the substances listed in the next few articles have an unpleasant way of getting on or into textiles; they should be promptly removed. In each case we will begin with a few questions that you should be able to answer from this text and from the texts you have studied before. Then we'll list some treatments that you can use, and suggest some practical applications of your theoretical knowledge. We'll deal with the stains in alphabetical order. This order will be convenient for quick reference later on.

ACID

Questions: 1) How can the presence of acid be shown? 2) What neutralizes acids? 3) What common substance may be used to neutralize acids? 4) What is the difference between mineral and organic acid? 5) Why is water used on an acid stain? 6) What are some common sources of acid stains?

Treatment: *A.* Sponge with plain water. *B.* Sponge with dilute ammonia. *C.* Then sponge once more with plain water.

ALKALI

Questions: 1) How can the presence of alkali be shown? 2) What common substances may be used to neutralize alkali? 3) What are some common sources of alkaline stains?

Treatment: The same as for acid treatment, except that neutralization is done with dilute acetic acid instead of ammonia. Try lemon juice or vinegar if acetic acid is not available.

BLOOD

Questions: 1) Why should not one treat a blood stain with hot water? 2) What is the effect of hydrogen peroxide on a

blood stain? 3) What is the easiest way of treating a dried blood stain?

Treatment 1: *A.* Work with a pad wet with cold water. *B.* Work with warm soap solution containing perborate. *C.* Sprinkle perborate powder on the stain and allow to stand. *D.* Work with the water-wet pad.

Treatment 2: *A.* Work with cold-water pad. *B.* Wet with peroxide. *C.* Sprinkle with perborate. *D.* Work with water-wet pad.

Treatment 3: *A.* Wet with warm water. *B.* Sprinkle with digestion powder. *C.* Keep the stain moist and warm for $\frac{1}{2}$ hr. *D.* Work with water-wet pad.

CHEWING GUM

Questions: 1) Why does water have no effect on chewing gum? 2) What is an important advantage of carbona as a dry-cleaning agent?

Treatment 1: *A.* Place the fabric, stain side down, on blotting paper. *B.* Work carbona in on the back of the stain. *C.* Move the stain to a clear and clean part of the blotter as the blotter takes up the gum. *D.* Rub the little remaining stain with a carbona-wet pad. *E.* Rub with water-wet pad.

Treatment 2: Use kerosene instead of carbona.

Treatment 3: Rub gum with ice and pick it off.

If you want to experiment with the methods given, you should get the following materials: acid, alkali, blood, gum, various fabrics, litmus paper, ammonia water, acetic acid, white absorbent cotton cloth, peroxide, perborate, soap, digestion powder, carbona, kerosene, and ice.

Chocolate, Coffee, Cream, and Dye

38. Now to another selection of stains that you may have to deal with.

CHOCOLATE, COCOA

Questions: 1) Of what does chocolate consist? 2) What could be used to remove the fat in chocolate or cocoa? 3) What could be used to destroy the color?

Treatment 1: *A.* Sponge with soap solution. *B.* Sponge with water till free of soap. *C.* Bleach. *D.* Sponge with water.

Treatment 2: *A.* Wet with water. *B.* Work with 20 per cent acetic acid. *C.* Sponge with water. *D.* Treat with ammonia and liquid soap. *E.* Sponge with water. *F.* Sprinkle with digestion powder. *G.* Keep the spot warm and moist for $\frac{1}{2}$ hr. *H.* Sponge with water. *I.* Bleach if necessary. *J.* Sponge with water.

COFFEE

Questions: 1) Of what does coffee consist? 2) How is the fat removed. 3) How is the sugar removed?

Treatment 1: *A.* Sponge with carbona to remove the fat. *B.* Sponge with water to remove the sugar. *C.* Work hot glycerine into the stain. *D.* Let stand for $\frac{1}{4}$ hr. *E.* Sponge with water. *F.* Apply alcohol containing 10 per cent glacial acetic acid. *G.* Sponge with water. *H.* Bleach if necessary. *I.* Sponge with water.

Treatment 2: *A.* and *B.* are the same as in Treatment 1. *C.* Sprinkle with perborate powder. *D.* Keep the spot wet with peroxide until bleached. *E.* Sponge with water.

CREAM

Treatment 1: Sponge with soap solution and then sponge with water.

Treatment 2: Sponge with carbona followed by sponging with water.

DYE

Questions: 1) Why is it difficult to remove a dye stain from colored fabric? 2) Under what conditions do animal fibers dye? 3) Under what conditions do vegetable fibers dye?

Treatment 1: (For animal fibers, acetate, and synthetics.) Sponge with cold soap solution and then sponge with water.

Treatment 2: (For vegetable fibers and rayon.) Sponge with dilute acetic acid and then sponge with water.

Treatment 3: Depending on the fiber at hand, treat the same as in Treatments 1 and 2 respectively. Then bleach with a suitable chemical and follow by sponging.

If you want to experiment, get the following materials: fabrics stained with chocolate, cocoa, coffee, cream, and dye; carbona, peroxide, perborate, hypochlorite, permanganate, bisulfite, soap solution, acetic acid, ammonia solution, digestion powder, glycerine, and alcohol.

Fruit, Grass, Gravy, and Grease

39. The selection of stains in this article seem to be ideally suited for first aid on a picnic.

FRUIT

Questions: 1) What part of the fruit stain offers the most trouble? 2) How is the color removed? 3) Why cannot a chlorine bleach be used on wool?

Treatment 1: *A.* Work warm glycerine into the stain. *B.* Sponge with water. *C.* Apply alcohol containing 10 per cent glacial acetic acid. *D.* Sponge with water. *E.* Bleach—if necessary and possible to do so. *F.* Sponge with water.

Treatment 2: (For citrus fruits) *A.* Sponge with water. *B.* Sponge with ammonia solution and then sponge with water.

GRASS

Treatment 1: *A.* Work spot with soap solution. *B.* Work few drops of amyl acetate into stain. *C.* Sponge with water.

D. Bleach—if necessary and possible to do so. *E.* Sponge with water.

Treatment 2: *A.* Work stain with amyl acetate. *B.* Sponge with naphtha. *C.* Bleach if necessary and possible.

Treatment 3: *A.* Work with kerosene. *B.* Work with naphtha. *C.* Bleach if necessary and possible.

GRAVY

Treatment: *A.* Wet with water. *B.* Apply a few drops of ammonia. *C.* Work with soap solution. *D.* Sponge with water. *E.* If necessary, sprinkle with digestion powder. *F.* Keep the stain warm and moist for ½ hr. *G.* Sponge with water.

GREASE

Questions: 1) What are some sources of grease stains? 2) Why is water not used to remove grease? 3) How does soap remove grease? 4) What are some of the solvents used for grease?

Treatment 1: *A.* Sprinkle with an absorbent powder. *B.* Work with soap solution. *C.* Sponge with water.

Treatment 2: Sponge with a dry-cleaning solvent.

If you want to experiment, get the following materials: stained materials, glycerine, acetic acid, ammonia, soap, amyl acetate, naphtha, kerosene, digestion powder, and absorbent powder.

Ice Cream, Ink, and Iodine

40. As we follow the stains in alphabetical order, we come to three types often found in connection with children of school age.

ICE CREAM

Questions: 1) What are the three constituents of ice cream? 2) How may cream be removed? Sugar? Coloring matter?

Treatment 1: *A.* Sponge with naphtha. *B.* Sponge with water. *C.* Bleach—if necessary and possible.

Treatment 2: *A.* Sponge with soap solution, then with water, and bleach if necessary.

WRITING INK

Question: Why is it not possible to have one chemical remove all ink spots?

Treatment 1: *A.* Saturate with glycerine and sponge out with water. *B.* Use ink remover after testing the effect on the dye. *C.* Sponge with water. *D.* If necessary, follow through with oxalic acid solution. *E.* Sponge with water. *F.* Use hydrosulfite if necessary and if possible.

Treatment 2: Sponge with a mixture of equal parts of carbona and lysol.

Treatment 3: Sponge with a mixture of oxalic acid, glycerine, and wood alcohol.

PRINTING INK

Treatment: *A.* Work a colorless grease into the stain. *B.* Sponge with carbona.

IODINE

Treatment 1: Sponge with a soap solution.

Treatment 2: *A.* Place a few hypo crystals in corner of a folded piece of cloth. *B.* Soak in a 10 per cent ammonia solution. *C.* Pat the stain with the wet corner until the blemish vanishes. *D.* Sponge with water.

Treatment 3: Sponge with ammonia solution. Wet an old stain with a little fresh iodine before treating it according to Treatment 2.

If you want to experiment, get the following materials: fabrics stained with the materials considered; naphtha, soap, bleaches, glycerine, hydrosulfite, oxalic acid, carbona, wood alcohol, hypo, and ammonia water.

Iron Rust, Lipstick, Mercurochrome, and Mildew

41. While rust, lipstick, and mercurochrome all cause red spots, they differ widely in the methods used for removal.

IRON RUST

Questions: 1) Of what does iron rust consist? 2) Why does washing fail to remove rust stains? 3) What means are employed to remove iron rust?

Treatment 1: *A.* Sponge with water. *B.* Apply erusticator on a stick. *C.* Sponge with water.

Treatment 2: *A.* Apply a drop of dilute solution of warm oxalic acid. Then sponge with water.

Treatment 3: *A.* Apply a dilute solution of hydrochloric acid. *B.* Sponge with water. *C.* Sponge with ammonia solution. *D.* Sponge with water.

LIPSTICK

Questions: 1) What are the two main constituents of lipstick? 2) How is the grease removed? The color? 3) What is meant by the lubrication method of stain removal?

Treatment 1: *A.* Work a colorless grease into the stain. *B.* Bunch-up the material and dip into carbona. *C.* Brush with solvent. *D.* Touch with glacial acetic acid. *E.* Brush with solvent.

Treatment 2: *A.* Work colorless grease into the stain. *B.* Dip into carbona. *C.* Bleach if necessary and possible to do so. *D.* Sponge with water.

MERCUROCHROME

Treatment: *A.* Sponge with soap solution. *B.* Bleach and then sponge with water.

MILDEW

Questions: 1) Define mildew. 2) How does it form? 3) What effect does it have on various materials?

Treatment: *A.* Use soap solution. *B.* Bleach and then rinse well.

If you want to experiment, get the following materials: materials stained with the spots discussed; erusticator, oxalic acid, hydrochloric acid, ammonia, colorless grease, acetic acid, soap solution, and bleaches.

Mud, Mustard, Paint, and Scorch

42. Here is another group of stains, each presenting problems in removal.

MUD

Questions: 1) Give two ways of treating mud stains? 2) How should a dry mud stain be treated? 3) What liquid may be used to remove a mud stain?

Treatment: *A.* Allow spot to dry thoroughly and then brush. *B.* Sponge the spot with soap solution. *C.* Sponge with water.

MUSTARD

Treatment: *A.* Saturate the stain with hot glycerine. *B.* Sponge with water. *C.* Apply 20 per cent acetic acid. *D.* Sponge with water. *E.* Bleach. *F.* Sponge with water.

PAINT

Look at the constituents of an oil paint on the label of a can.

Treatment 1: (For fresh stain.) *A.* Brush with soap solution. *B.* Sponge with water.

Treatment 2: *A.* Rub lard into the fresh stain. *B.* Brush with soap solution. *C.* Sponge with water.

Treatment 3: *A.* Apply ammonia solution. *B.* Apply turpentine, carbona, or benzene. *C.* Allow to stand for 15 min. *D.* Brush with soap solution. *E.* Sponge with water.

SCORCH

Questions: 1) Of what does a scorch consist? 2) Why can it not be dissolved out?

Treatment: *A.* Brush with soap solution. *B.* Sponge with water. *C.* Bleach if necessary.

Application: Treat scorched materials and note results.

If you want to experiment, get the following materials: materials that have spots or stains as just discussed; brush, soap solution, glycerine, 20 per cent acetic acid, bleach, lard, ammonia solution, turpentine, carbona, and benzene.

Tar, Tomato Sauce, Wax, and Wine

43. Now to the last group of stains discussed here in detail.

TAR

Treatment 1: *A.* Rub lard into the stain. *B.* Brush with soap solution. *C.* Sponge with water.

Treatment 2: *A.* Rub lard into the stain. *B.* Brush with carbona. *C.* Sponge with carbona.

TOMATO SAUCE

Questions: 1) What are the constituents of tomato sauce? 2) How can the fat be removed? 3) How can the color be removed?

Treatment: *A.* Sponge with carbona. *B.* Sponge with soap solution. *C.* Bleach and then sponge with water.

WAX

Treatment: *A.* Scrape off as much of the wax as possible. *B.* Place the spot between blotters. *C.* Press with a hot iron. *D.* Sponge with carbona. *E.* Bleach if there is a stain from the wax color existing. *F.* Sponge with water.

WINE

Treatment: *A.* Sponge with water. *B.* Sponge with acetic acid. *C.* Sponge with banana oil and lactic acid. *D.* Bleach. *E.* Sponge.

If you want to experiment, get the following materials: fabrics which contain the stains studied; carbona, soap, bleaches, blotter, pressing iron, acetic acid, banana oil, and lactic acid.

Use of Chart for Quick Action

44. If you are in a hurry to remove a spot, you can use the following reference chart for spot and stain removal in the care of clothing. The chart is for ready reference in a general way. Keep the following points in mind: 1) Bleaching agents should not be used on dyed fabrics. 2) For a bleach on animal fibers, use peroxide. Chlorine should never be used as a bleach on animal fibers. 3) For a bleach on vegetable fibers, use any bleach, such as peroxide or chlorine.

Art Mending

How to Remove Holes and Tears

45. Spots and dirt are not the only faults that may develop in cloth during wear. There is also the danger of the cloth being exposed to tears, and to burns, such as a cigarette burn. The art of removing such faults is known as reweaving, art weaving, invisible weaving, French weaving, or art mending. No matter what the name, the idea is to remove the hole in the cloth in such a manner that the place where the mending has been done is more or less invisible.

There are three ways in which to mend a hole or a tear in a piece of cloth or a garment. The first way, which is generally used on cigarette burns and other small holes, is to replace the burned section by reweaving. The second way is used on tears in which the edges are not raveled; this is called stoting. With this method you butt the two torn sides together so that the mending will not show on the surface. The third way, which is used on large tears or holes, is to patch the cloth

TABLE 1

SPOT REMOVAL CHART

SPOT OR STAIN	MATERIAL	CHEMICAL TREATMENT	PROCEDURE
Acid	Any	Water and household ammonia	Sponge
Adhesive	Any	Carbon tetrachloride	Sponge, then rub
Blood	Any	Lukewarm saline solution	Immediately soak and then use regular laundry methods
Blood	Any	Solvase in solution	Immediately soak and then use regular laundry methods
Blood	Heavy goods and wool	Use raw starch paste as absorbent	Keep applying to spot until it disappears
Bluing	Any	Soap solution; use solution of soap and water of sulfonated oil and water. If made in stock solution, the addition of 1 part of ether to 30 parts of solution will be of value in spot removal	Rub carefully
Butter	Any	Carbon tetrachloride	Sponge and rub
Candle Wax	Any	Carbon tetrachloride	Sponge and rub
Candy	Any	Water and soap solution	Sponge and rub
Chewing Gum	Any	Carbon tetrachloride	Sponge and rub back of stain
Chocolate	Any	Water, soap, and then bleach	Sponge and rub
Cocoa	Any	Water, soap, and then bleach	Sponge and rub
Coffee	Any	Water, soap, and then bleach	Sponge and rub

Dye	Any	Water, soap, and then bleach if possible	Sponge and rub
Egg	Any	Water and soap	Sponge after scraping
Fruit	Any	Soap solution, then bleach	Sponge and rub
Furniture Polish	Any	Soap solution, then water	Sponge and rub
Glue	Any	Soap solution	Sponge and rub
Graphite	Any	Dry spotting soap; 2 parts oleic acid, 1 each of chloroform, carbon tetrachloride, and benzol; ⅓ part denatured alcohol, ¼ part of 26 per cent ammonia. Keep in corked bottle	Sponge and rub
Grass	Any	Alcohol	Sponge and rub
Grease, Oil	Any	Carbon tetrachloride	Sponge and rub
Gum	Any	Carbon tetrachloride	Sponge—from back of fabric first
Hair Oil	Any	Dry spotting agent; 1 part each of chloroform, benzol, and carbon tetrachloride	Sponge and rub
Ice Cream	Any	Water, soap, and then bleach	Sponge in sequence
Indelible Pencil	Any	Alcohol or soap solution	Sponge and rub well
India Ink	White goods	Soap solution	Sponge and rub the fresh stain
Ink	Any	Water, soap, and then bleach	Sponge and rub
Iodine	Any	Hypo (sodium thiosulfate)	Sponge carefully
Iron Rust	Cotton, linen	Treat with weak solution of oxalic acid and then with ammonia	Acid applied to stain with glass rod; on disappearance of stain, apply ammonia and rinse with water
Lead Pencil	Any	Try erasing; soap solution	Sponge carefully

TABLE 1—*Continued*

SPOT REMOVAL CHART

SPOT OR STAIN	MATERIAL	CHEMICAL TREATMENT	PROCEDURE
Leather	Any	Soap and water	Sponge vigorously but with care
Linseed Oil	Any	Carbon tetrachloride	Sponge and rub
Lipstick	Any	Use colorless grease such as petroleum jelly or vaseline. Follow with carbon tetrachloride. Use care	Rub the grease in; then sponge well but evenly
Medicine	Any	Alcohol, soap solution	Sponge very carefully
Mercurochrome	Any	Soap solution, bleach, and then water	Sponge well
Metallic Stains	Any	Acetic acid	Sponge carefully
Mildew	Any	Soap and then bleach	Wash well before using bleaching agent
Milk	Any	Soap solution	Sponge and rub
Mud	Any	Allow to dry, brush; sponge from back with soap solution	Sponge with water
Mustard	Any	Hot glycerine; sponge with water, apply 20 per cent acetic acid and then sponge with water. Bleach and sponge again with water	Sponge with water
Old Paint, Old Varnish	Any	Equal parts of alcohol and benzene, or use turpentine	Sponge vigorously but with care
Paint	Any	Turpentine or benzene	Sponge vigorously

Pencil Marks	Any	Try erasing the marks. Soap and water may help	Rub, carefully, the detergent used on goods
Perspiration	Any	Difficult stain to remove. Use a soap-and-water solution. If peroxide is used, take particular notice of its bleaching properties.	Sponge with utmost care
Salad Dressing	Any	Carbon tetrachloride	Sponge carefully
Scorch	Any	Soap solution and bleach	Sponge
Shellac	Any	Alcohol or benzene	Sponge with care
Sugar	Any	Warm to hot water	Sponge well
Tar, Road Oil, Creosote Oil	Any	Carbon tetrachloride	Sponge with care
Tea	Any	Soap solution (difficult spot to remove since it is tannic acid)	Sponge immediately
Tin Foil	Any	Soap and water	Sponge
Tobacco	Any	Hot water and soap; bleach if necessary	Sponge; the degree of intensity depends on depth of stain
Tomato	Any	Soap solution	Sponge and rub
Varnish	Any	Alcohol or benzene	Sponge with care
Vaseline	Any	Carbon tetrachloride	Sponge with care
Water	Any	None	Steam carefully; wash entire garment
Water Colors	Any	Soap solution	Sponge and rub
Wax	Any	Carbon tetrachloride	Sponge and rub
White Sauces	Any	Soap and water	Sponge carefully

with a piece of new material, in such a way that the new material blends with the design of the mended fabric.

Reweaving

46. One prerequisite for successful reweaving is a thorough knowledge of fabrics. Then, you'll need some basic supplies. First of all, you must have a few good needles. Since they have to be hand-polished, they are usually imported from England. Besides needles you'll need shears, tweezers, a padded block to which the material can be pinned, and a wooden block that can be put under the hole while mending.

The first step in reweaving is to place the material upside down and to cut the hole square, so that no warp or filling threads are cut diagonally. Take the yarns used for mending from the cloth of the garment itself. In a garment the filling yarns may be taken from the trouser cuffs, or the ends of the sleeves. The warp yarn can best be taken from the seams. Of course you must remember that if you take these yarns, the seam must be restored afterward so that it will not ravel. The yarns to be used should be at least 1 in. longer than the length of the hole to be mended. Thus, if you have a $\frac{1}{2}$-in. hole, your mending yarns must be at least $1\frac{1}{2}$ in. long, preferably longer.

Mending is usually started by inserting the filling first. Thread the needle and push it through the center of the first pick at the side of the hole. Lead the point of the needle across the hole and insert it through the center of this same pick on the other side of the hole. Then let the yarn slide out of the needle, so that about half an inch sticks out on each side of the hole. The same procedure is followed until every pick has been inserted.

After the picks have been inserted, you follow the same procedure with the ends, with this difference: after you have inserted the needle through the center of the first broken end, you go over and under the filling in exactly the same manner as the original ends interlaced in the weave. So you must

know in the first place how those ends interlace. This is the reason why you can never do successful reweaving unless you have studied the weave of the cloth to be rewoven.

After every pick and every end has been inserted, tweezers are used to pull the ends and picks tight. The loose ends can then be cut off, and the former hole can be pressed. After the pressing has been carefully done, the damage should not show at all on the face of the cloth. It will require many months, if not years, of painstaking practice to acquire such technique in art mending that the hole will be actually invisible after mending.

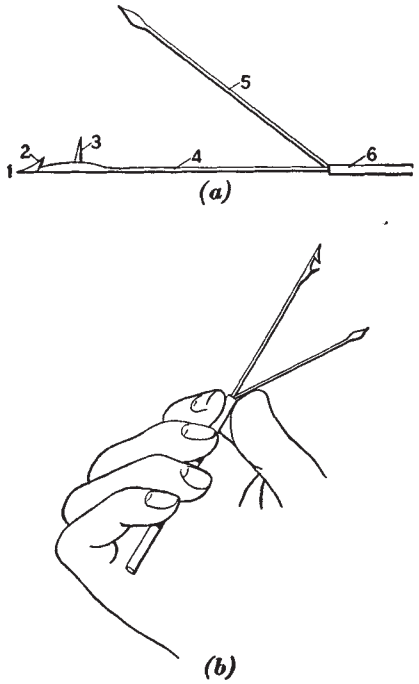
Stoting

47. For straight tears in which the threads are not raveled, such as where cloth has been cut accidentally with a knife or a razor, another method is used. This method, known as stoting, consists of butting the two sides of the tear. The two sides are put together carefully, and pinned down. A fine thread, such as silk or nylon, is inserted in a very thin needle. The needle is led through the cloth itself from one side of the tear to the other.

The trick in stoting is to have the needle, and consequently the sewing thread, show on neither side of the fabric. The mending should be in the center of the fabric and hidden from sight. The sewing yarn used must be very fine; if necessary, a fine silk twist can be opened and only one single used. The tension in sewing must be carefully controlled so that the place where the cut has been does not bulge. Again, the principles of stoting are simple, but it requires practice and manual dexterity to become a master of the art.

Patching

48. For large tears or holes, you can use patching. Sometimes patching is used on small holes too, because it is easier to learn than reweaving. For patching, a piece of cloth is cut



1. point
2. hook
3. latch
4. shank
5. arm
6. handle

FIG. 7. NEEDLE FOR PATCHING

that is at least 1 in. longer and wider than the hole or cut. The sides are raveled, so that there are loose ends and picks protruding for about ½ in. on every side. A special weaving needle is used for this type of work.

The special needles used for patching vary in construction, but the principle is the same in all of them. One such weaving needle is illustrated in Fig. 7 (*a*). In the illustration the needle is shown open. When the arm of the needle is pressed down, the point of the arm presses on the latch. The latch is pressed down into the hook behind the point. In the closed position the needle can be pushed through the cloth. In

another model of needle the arm is operated by a button in the handle. The shank looks like a grooved needle with an eye near the point. The point of the arm fits into the eye.

For practice, put the raveled patch over the hole, on the surface of the cloth. Care must be taken to match stripes, plaids, or other patterns. When the patch is in the right position, it is basted down. Hold the needle as shown in sketch (*b*) of Fig. 7. Beginning on one corner, the first raveled end of the patch is grasped by placing it between the hook and the latch, and pressing the arm down. Then push the needle through the cloth, pulling the end with it. Finally, release the arm and pull the needle back, while the raveled end remains on the other side of the fabric. This same sequence is followed with every end, first on the top of the patch and then on the bottom. Treat the raveled picks on both sides of the patch in the same manner. When the patching is properly done, all loose threads will be on the back of the fabric; the patch is on the surface, held in place by the ends that go through the fabric.

The patching operation is completed by pulling all the loose yarns tight. They are placed flat on the back of the cloth, and the mended portion is pressed with an iron and a damp cloth.

Consumer Testing

Why Textiles Are Tested

49. Fundamentally, there are two different reasons for textile testing: 1) There is textile testing for quality and production control in manufacturing. Evenness tests for card slivers and strength tests for yarns fall into this category. 2) There is fabric testing for the consumer. This includes tests for wear and tear, for color fastness, and so on. At this point we'll deal primarily with this second type of testing.

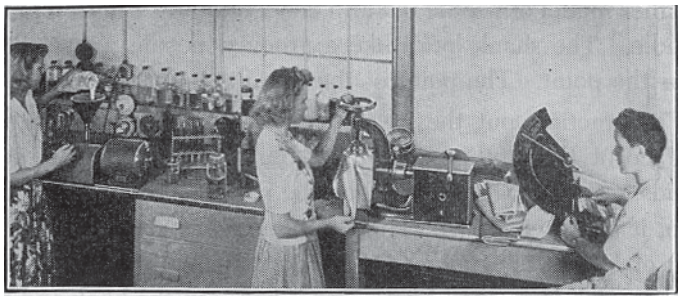


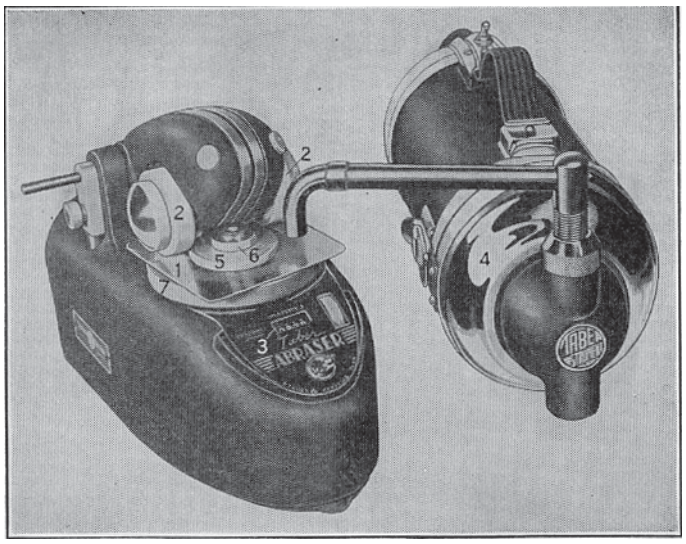
FIG. 8. TEST LABORATORY

To do a complete job of consumer testing, you would need elaborate equipment. In Fig. 8, for instance, you see three test technicians in a part of the laboratory of the Textron Corporation. The girl at the left is testing dope, that is, a solution used for waterproofing. The girl in the center is testing the bursting strength of a fabric, and the one at the right is testing breaking strength. In the following articles we'll look at some of the instruments used in consumer testing and learn how they work.

Abrasion Tests

50. One major consideration in buying a garment is: "How will it wear?" The seat of the garment will rub on the chair, the elbows will rub on the table, and so on. In testing for wear, machines are used to simulate the rubbing action, or abrading action, as it is called. Let's look at the Taber abraser, a machine used to measure the resistance to wear of textile or other materials. In Fig. 9 the tester is shown while testing a plastic plate.

In the Taber abraser the sample is held on a turntable. Two abrasive wheels rotate on the sample in the testing action. The pressure of the wheels on the fabric may be varied from 125 grams to 1,000 grams. Abrading wheels of different coarseness can be used. The machine is equipped with a counter which records the number of turns applied to



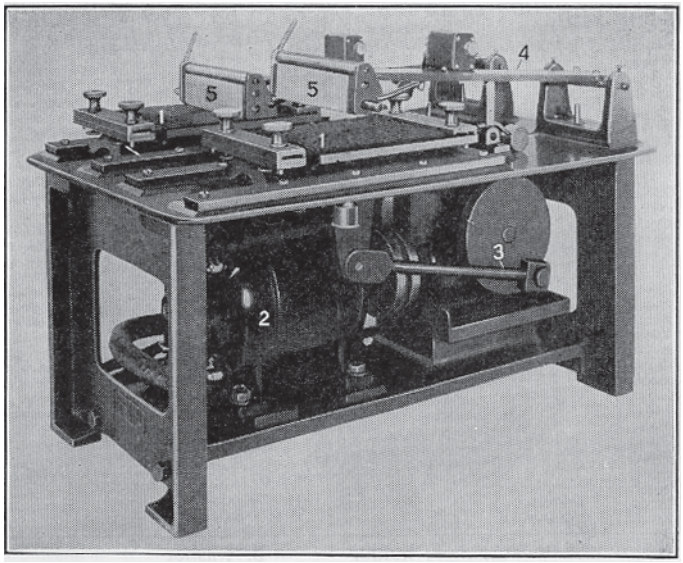
1. sample holder
2. abrasive wheels
3. counter
4. vacuum pickup
5. washer
6. nut
7. ring

FIG. 9. TABER ABRASER

the sample being tested. The machine also has a vacuum pickup which removes the fibers that are rubbed from the fabric in testing.

To test cloth in the Taber abraser, fold the sample in half, twice; then cut a small hole in the center of the cloth. Mount the fabric on the sample holder and clamp it down with the washer and nut. The sample is made smooth by forcing the ring on the edge of the turntable over it. Tighten the nut in the ring and cut off any excess material. Then tighten the center nut and the sample is ready for the test.

Before beginning the test, reface the wheels by running them against abrasive paper on the refacing holder. Then put the sample holder, with the prepared sample, in the machine and set the counter at zero. In testing, you normally use a pressure of 500 grams and No. 10 wheels. The test is run for



1. samples
2. motor
3. crank
4. lever arms
5. abrading material

FIG. 10. ABRASION TESTER, UNITED STATES TESTING COMPANY

the number of cycles necessary to impair the serviceability or appearance of the fabric. You'll need anywhere from 500 cycles to 5,000 cycles to show visible wear.

51. As you have seen, the Taber abraser uses a rotary motion for testing. Other abrasion testers may use a uniform or a variable rectilinear motion; still others use an oscillating motion. One of the abrasion testers used by the United States Testing Company is shown in Fig. 10. Two samples are clamped on this tester. For woven fabrics, you usually place one sample warp-wise and the other filling-wise. A motor, working through a crank, gives an oscillating motion to the samples. Lever arms that hold the abrading material are lowered on the sample to be tested. You can test in such a machine for specific purposes. For example, cloth samples can

be prepared with a lengthwise fold in them, to correspond to the wearing action on the cuff of a suit.

In actual tests, compare the wearing qualities of two similar fabrics. Record the number of rubs at which pilling will occur, the rubs when a lengthwise yarn breaks, and the rubs when a crosswise yarn breaks. Of course you must use the same emery cloth or other abradant to obtain comparable results in each test.

Materials used as abradants will also vary according to the results wanted. The abrasion tests can show when wear of a fabric results in loss in thickness, loss in weight, and increase in porosity to air; and they can show the change in the light-reflecting power, or luster.

Water Resistance Tests

52. One of the questions the consumer has, at least in regard to outerwear, is whether the garment will keep the rain out. The resistance of a fabric against getting soaked through is called its water repellency. Various types of tests are used for water repellency. Tests are conducted on the samples before and after the washing and dry-cleaning tests. Immersion, spray, spot, and hydrostatic methods may be used. Shower-resistant, rain-resistant, and waterproof factors are interpreted from the results of testing. The finishes applied to the goods are known as repellents; and while they furnish varying degrees of resistance, as yet there are no definite standards for water repellancy. The point, however, at which a fabric has to allow water penetration, or water permeability, can be tested.

A hydrostatic tester, used to test water permeability, is shown in Fig. 11. The principle of this machine is simple. A water container is suspended on a screw. When the screw turns, the container is raised. A hose leads the water to the cloth sample, which blocks the opening of the hose. The higher the water container is raised, the stronger will the

1. water container
2. screw
3. hose
4. waste can
5. indicator
6. sample holder
7. cam lever
8. water valve
9. motor
10. clutch
11. inclined mirror

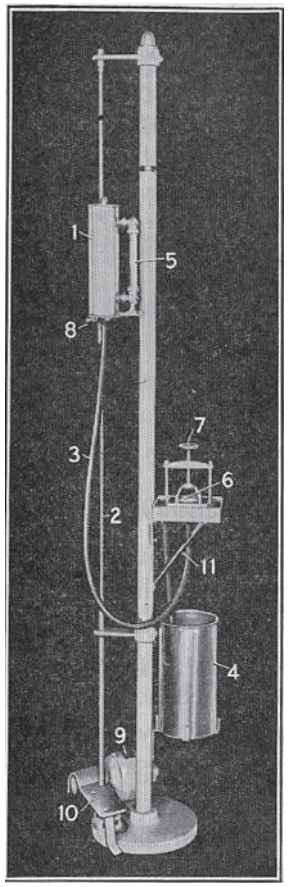


FIG. 11. HYDROSTATIC TESTER, UNITED STATES TESTING COMPANY

water press against the cloth. Finally, the water will penetrate the cloth and run off into the waste can.

53. To use the water permeability tester, Fig. 11, set the indicator at zero on the vertical scale of the machine. Place the sample over the opening in the metal ring of the sample holder. Clamp the sample securely by means of the cam lever. Make sure that there is no distortion of the fabric to be

tested. Open the water valve. Turn on the motor and press down on the clutch.

Observe the surface of the sample through the inclined mirror underneath. Disregard any water drops which may occur at the circle of contact. As soon as three drops at three separate points have been observed, throw the clutch into neutral. Read the scale and record the height in centimeters. Repeat the test twice more and take the average of the three readings. When the indicator on the scale reaches 50 cm (centimeters), maintain this height until three drops appear or until 1 hr has elapsed.

The common classifications for readings on the machine are: 1) *Showerproof.* Between the 17- and 50-cm markings on the scale. Shower curtain, in particular, is in this range. 2) *Rainproof.* If a fabric repels water at the 50-cm mark, it is said to be rainproof. Rainwear usually comes in this category. 3) *Waterproof.* If the fabric repels water at the 50-cm mark and does not show any seepage or drops of water for 1 hr, the fabric is considered waterproof. Heavy-duty rainwear and many industrial fabrics are in this class.

Air Permeability Tests

54. If there is an icy wind, you want a fabric to keep the cold air out. On a warm day, you want a fabric that is porous, so your skin can breathe. A parachute or a tent should resist the air flow. An industrial filter cloth should let the air pass, but stop the dust. In short, whether desired or not for a specific fabric, the air permeability of a fabric is important.

Air permeability is the ability of air to pass through the openings, or interstices, of a fabric. A test will show the openness or porosity of fabrics by measuring the air flowing through the fabric, as indicated by a standard test measurement on specially made machines.

The air permeability tester consists of two chambers separated by an opening of variable size, with a suction fan which

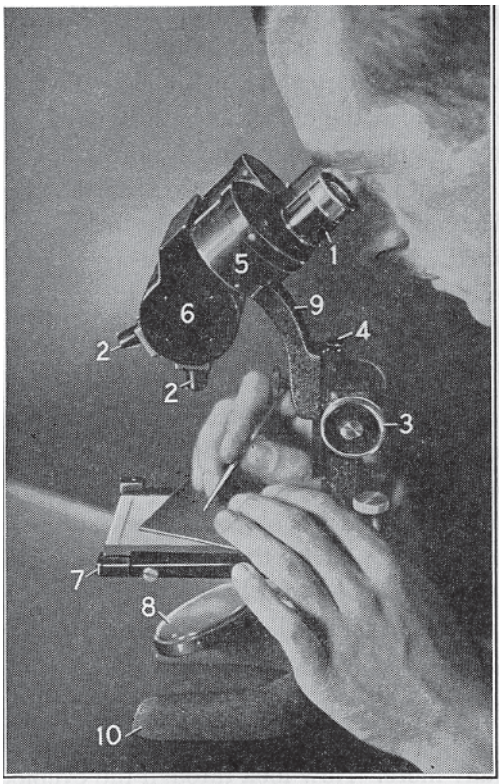
draws air through the sample being tested. When the chamber that is farther from the sample shows a pressure of 0.5 in. of water, a reading is taken from the manometer which is connected with the chamber that is closer to the sample. The manometer is a hollow glass rod which contains the red fluid used in the reading on the machine. From the manometer reading, the number of the orifice used, and the curve for each orifice, it is possible to read the true air permeability for the fabric. A rheostat on the machine is used to regulate the machine during the testing.

For the test, an orifice should be used which gives a reading between 3 and 13 on the manometer scale. Find the cubic feet of air per minute per square foot of fabric; to do this, use a chart for the orifice used and for the vertical scale reading. Charts come with the machine for this purpose.

Microscopic Tests

55. The microscope, Fig. 12, is a very useful tool in textile testing. It permits you to see details that cannot be observed by the unaided eye. With the aid of a microscope, you can see the differences between various fibers, fabrics, and finishes. For example, you can determine the grades and qualities of fibers, the amount of fiber content in a mixed fabric, the degree of mercerization on cotton goods, and the construction of fibers.

Enlarging is done in the microscope by two lens units. The unit located near the eye is known as the eyepiece or ocular; the other lens unit near the object to be tested is known as the objective. The magnification of the microscope is found by multiplying the magnification of the eyepiece by the magnification of the objective. For instance, if a 10× eyepiece is used with a 60× objective, anything seen through the microscope will be magnified 10×60, or 600, times. In most textile work, 100×, 300×, and 600× enlargements are used. That is, you'll find three objectives on most textile microscopes.



1. ocular
2. objective
3. coarse adjustment
4. fine adjustment
5. body
6. nose piece
7. stage
8. mirror
9. arm
10. base

FIG. 12. MICROSCOPE

The coarse adjustment on the microscope is used to raise or lower the body, to bring the object into focus so that it may be seen. The fine adjustment is used for the final focusing and should be turned no more than a few turns in either direction. A very sharp contrast of the object being magnified should be obtained. If more turning is necessary it indicates that the coarse adjustment was not used enough.

The nosepiece holds two or more objectives of different magnifying powers, and it permits quick changing of objectives to obtain different magnification. The stage supports the glass slide on which the object to be magnified is placed. A hole in the stage permits light from a mirror to come through the object so that it may be seen. Clips on the stage hold the slide in place and keep it from slipping off when the microscope is tilted. In carrying the microscope, it should always be held by the arm and in upright position. An inclination joint permits tilting of the microscope to a comfortable angle. The horseshoe base supports the microscope.

56. To use the microscope, place the prepared slide on the stage. Move the slide until the object on it is over the center of the hole in the stage. Move the clips over the ends of the slide. Turn the low-power objective into position. Hold the base of the microscope with the left hand, and with the right hand, tilt the microscope to a comfortable angle. Adjust the mirror to reflect maximum light through the microscope.

With the eye close to the stage, carefully lower the microscope tube by turning the coarse adjustment until the objective almost touches the slide or until the coarse adjustment cannot be turned any more. Now look through the eyepiece. Slowly turn the coarse adjustment to raise the microscope tube until the object or the slide surface comes into view. Move the slide to obtain a good view of the object. Work the fine adjustment until the object appears sharp and clear. Adjust the mirror for the best lighting conditions. For higher magnification, turn the nosepiece to an objective of higher power. Use the fine adjustment to bring the object into sharp focus again.

Preparation of Slides

57. When you use the microscope for fiber identification, you need slides. Lengthwise, or longitudinal, views and cross-sectional views are used for microscopic tests.

To prepare microscopic slides, clean a small sample of the fibers with hot soap solution for a few minutes in a test tube. If the fibers are white, stain them for a few minutes in a test tube of hot dye solution. Fibers that are dyed too dark may be stripped, that is, have the dye removed, in a test tube of hot hydrosulfite solution. Rinse and dry the fibers.

Place a small drop of glycerine in the center of a clean glass slide. Carefully cut about a $\frac{1}{4}$-in. length of fibers directly over the drop of glycerine. Spread out the fibers in the glycerine with dissecting needles. Lower a cover glass over the sample on the slide and press it down gently. With a blotter, remove any excess glycerine beyond the cover glass. Examine the fibers with the microscope.

For practice, you might prepare slides of different fibers and examine them with the microscope. Prepare slides of the following fibers and then sketch the appearance of each: wool, mohair, cotton, linen, rayon, acetate, nylon, and glass fiber.

Light-Fastness Tests

58. A fabric may wear like iron, yet may have to be discarded if the color fades. To evaluate the light fastness or color fastness to sunlight of dyed textiles, a machine known as the Fade-Ometer is used. Color fastness to light is influenced by such conditions as the dyestuff and fiber used, the source and intensity of the light, the temperature and the relative humidity of the air, and atmospheric contamination. The relative rates of fading of different textiles do not necessarily change to the same degree as the changes in these conditions. Neither can any one test show with certainty the relative fastness of the colors used on textiles under the widely varying conditions of use. Consequently, it is common practice to investigate the fastness of a material by exposure to a variety of those conditions under which it is likely to be used.

The Fade-Ometer does in a few hours what would require exposure in the elements for a week or more. A 40-hr treat-

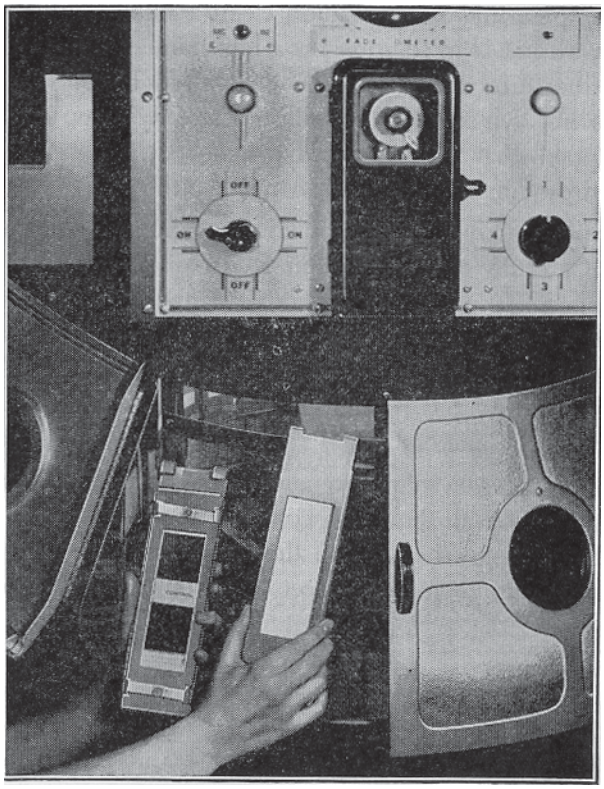


FIG. 13. FADE-OMETER

ment in the machine would equal about one month's time in the elements. In the machine the samples to be tested are exposed to light which is regulated to correspond to natural rays. The results are classified as fast to light, fairly fast to light, and not fast to light. Remember, however, that a color may be fast to washing and not fast to light, or vice versa.

59. The Fade-Ometer, shown in Fig. 13, produces light, a temperature of 100 F, and humidity comparable with that experienced on a hot, sultry summer day. The light is produced in the machine by an electric current which is fed to a carbon arc. Three carbons are used, one of 12-in. length and

two of 4-in. length. A pyrex globe surrounds the carbons. The machine is equipped with a fan and a trough filled with water. The fan circulates moist air while the tests are being conducted. There is a time clock on the side of the machine so that the exposures may be accurately checked in computing results. The machine has a capacity of 42 samples made up of 21 racks, each of which can hold two samples.

For tests, remove the back of the sample holder. Cut the samples to fit into the racks. Then lock the back of the holder into place with the exposed portion of the sample uncovered on both sides. Hang the sample on the circular frame around the globe and then turn on the power switch. Expose the samples for the required number of hours.

TABLE 2

TEST CHART FOR FADE-OMETER

[1]L1	L2	L3	L4	L5	L6	L7	L8
			Hours of Sunlight				
1½	3	6	12	24	48	96	192
3	6	12	24	48	96	192	384
			Hours of Fade-Ometer				
..	..	5	10	20	40	80	160
..	..	10	20	40	80	160	320

[1] L is the symbol for light.

Table 2 shows how the hours in the Fade-Ometer compare to exposure in actual sunlight. For example, look under L4. This is equivalent to direct exposure to light in a 12-hr day or in a 24-hr period. You get the same results by exposing the samples for 20 hr in the Fade-Ometer, removing some of the samples after 10 hr to note the intermediate results.

In most practical work, you would set the clock for a 20-hr exposure and test 3 samples of each fabric. Then mount samples of the original and the tested materials. Examine the tested fabrics for changes in shade.

Wash-Fastness Tests

60. To launder means to wash clothes and then to iron them with a flatiron or mangle. In tests for wash fastness, or laundering, you must consider time, temperature, mechanical action, washing solution used, dampening, and starching. Testing is done with the Launder-Ometer.

The Launder-Ometer consists of a copper tank supported on an iron frame. In this tank is a rotor which carries twenty standard pint jars in which the tests are carried out. The rotor turns at a speed of 40 rpm. During the test, small metal balls are used in the jars to intensify the action. The tank is filled to the proper level with water heated to the temperature desired for the particular test. The tank may be heated electrically, by gas, or by steam.

The sample to be tested and the solution to be used are placed in a jar which is then sealed and clamped in the machine. Twenty tests can be made at one time. The definite rate of speed provides the mechanical action needed in the testing. The water in the tank is heated to the temperature desired. This water maintains the samples and the solutions in the jars at the proper temperature.

61. To operate the Launder-Ometer, first locate the drain valve on the machine; it should be closed. Then fill the tank to the water line with water at a temperature lower than that required for the test. Set the temperature at 120 F. Turn on the Launder-Ometer switch. This will heat the washing solution in the jars to 120 F.

As soon as the Launder-Ometer reaches the dial temperature, place the prepared sample and ten $\frac{1}{4}$-in. steel balls in the jar with the solution. Seal the jars and clamp them quickly in the machine. Turn on the motor switch. Let down the cover and allow the machine to run for the required length of time. Then turn off the motor and Launder-Ometer switches. Remove, rinse, and then dry the samples.

The expression laundry-proof, when applied to fabrics and garments, means that these articles have been laboratory tested to withstand laundering without losing color or shrinking under normal washing conditions and length of time. The term may be applied only to fabrics which have been so tested. The seal "Laundry-Tested and Approved" is a seal awarded by the American Institute of Laundering to guide the public in the purchase of washable merchandise that has all the characteristics of launderability—color fastness to washing, sun, gas, and perspiration; adequate tensile strength; dimensional stability; and satisfactory construction.

Dye-Fastness Tests

62. You'll understand that the methods of washing cottons differ from those used to wash woolens and man-made materials. Cottons, of course, can be given more severe punishment in washing than other materials. The methods of making washing tests on cotton, woolens, and man-made fabrics are set forth by the American Association of Textile Chemists and Colorists (AATCC). Wash-fastness testing can be done in a washing machine or in a Launder-Ometer. Table 3 shows standard test conditions for various fabrics. The soap concentration of the solution should be 5% in all tests.

In practical work, fill the Launder-Ometer to the water line. Turn on the switch and set the temperature at 120 F. Cut each fabric to be tested into 2×4 in. pieces. Cut pieces of undyed white cloth to the same dimensions. Then staple a piece of white cloth to the piece of fabric to be tested, and use both together as a test sample.

Pour into the jar 100 cu cm (cubic centimeters) of 0.5 per cent soap solution which has been previously heated to the test temperature of 120 F. The prepared sample and the ten $\frac{1}{4}$-in. steel balls are placed in the jar. The jar is then sealed. Clamp the jar in the Launder-Ometer and turn on the motor. Allow machine to run for $\frac{1}{2}$ hr. Empty the jar and then rinse

TABLE 3

LAUNDERING TESTS

TEST NUMBER	TEMPERATURE DEGREES F	SODA ASH PERCENTAGE	AVAILABLE CHLORINE PERCENTAGE	TIME IN MINUTES
COTTON				
1	105	None	None	30
2	120	None	None	30
3	160	0.2	None	45
4	182	0.2	0.1	45
RAYON				
1	105	None	None	30
2	120	None	None	30
3	160	None	None	30

WOOL: Samples are washed in the Launder-Ometer with 100 cu cm of 0.5 per cent soap solution for ½ hr at 100 F. The samples are then removed, rinsed, and air dried, and finally pressed with a damp cloth.

the sample. After wringing out, press the sample dry. In pressing, make sure that the white cloth of the prepared sample is on top of the dyed piece of fabric. Compare the tested sample with the original sample. Observe whether the dye runs and whether the white material has become stained.

Perspiration Tests

63. All of us have had unpleasant experiences with perspiration and its effect on clothing. Tests are designed to show whether dyed fabrics resist acid and alkaline perspiration. Laboratory test results should be consulted prior to the selling of any fabric or garment as "perspiration-proof."

For testing, cut two strips of dyed fabric to a width of 2 in. Do the same with two strips of white material. The white fabric is used in the test to determine if its fibers or yarns will be stained by the dye that is loosened by the perspiration. When this perspiration dries, it will deposit the dye unevenly, thereby giving what is known as a wood-grain effect. Perspi-

ration may also change the shade or color of the dyed fabric by chemical action.

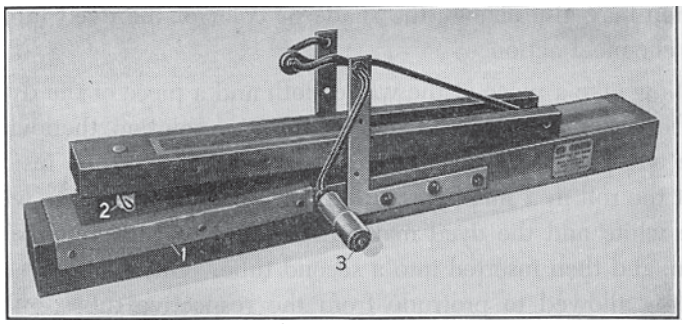
Now take a piece of the white cloth and a piece of the dyed cloth. Wet them with an acid-perspiration solution, then wind the two pieces into a roll with the dyed fabric on the inside. Put the roll in a small glass tube. A second roll is made with the white and the dyed materials, wetted with alkaline solution, and then inserted into a second tube. One third of each roll is allowed to protrude from the respective tubes. The samples, after testing, are then dried in an oven at 100 F, which is comparable with the heat in the human body.

The acid solution for the test is prepared with 10 grams of salt, 1 gram of 85 per cent lactic acid, and 1 gram of disodium orthophosphate, anhydrous. Place these into a mixer and make up 1 liter with water. The alkaline solution consists of 10 grams of salt, 4 grams of ammonium carbonate, 1 gram of disodium orthophosphate, anhydrous. These are made up into 1 liter with water.

Perspiration when first formed is acidic in nature; it will, however, become alkaline after standing for a time. This is the reason why two solutions are used in the perspiration test. The exposed part of the roll of fabric will dry more rapidly than the inserted part of the roll. When you try to compare the test results with actual wear conditions, you must keep in mind that garments are not rolled around a person evenly like the cloth in your test roll. Some parts of a garment on a perspiring person are held tight, for example, at the belt; hence these portions of clothing will dry much more slowly. The looser portions of clothing will dry rapidly. After the samples are dry, they should be thoroughly examined to determine whether the fabric is fast to perspiration, fairly fast, or poor.

Crocking Tests

64. To find out what is meant by crocking, hold a piece of bleached white fabric over the finger and then rub it 10 or 12



1. emery cloth *2.* finger with clip
3. handle

FIG. 14. CROCKMETER

times over a poorly dyed material. The color will rub off to some degree onto the white goods. This rubbing off of dyestuff is called crocking. It is very objectionable—for instance, when a blue jacket stains a white shirt.

The crockmeter, shown in Fig. 14, is an apparatus designed to measure, under standard conditions, the degree of color fastness that dyed fabrics have to crocking. In making tests, place the sample to be tested over the emery cloth on the base of the Crockmeter. Place white cotton fabric over the Crockmeter finger and fasten it by means of the spiral clip. Turn the handle ten times to move the finger back and forth over the dyed material. Remove the white cloth from the finger and examine it closely to see whether or not staining is apparent.

The sample should be about 2×5 in., and should be rubbed on the bias. That is, from one corner to the other, not parallel with the warp or the filling. The size of the white material used should be about 2×2 in. Make two tests on each material: one with the white material dry; the other with a wet, but wrung-out, white piece of cloth. The two white pieces are kept for records; one should be marked "dry crocking," while the other is labeled "wet crocking."

Shrinkage Tests for Wool Fabrics

65. The only shrinkage we want to study here is the shrinkage that affects the tailor and consumer most closely—the shrinkage during sponging of the cloth before it is made into clothing. At another time you can study other types of shrinkage in textile finishing if you are interested in them.

The sponging process is designed to shrink a wool fabric as much as pressing with steam would shrink it. What the process really does, is to relax the tensions in the yarns that form the cloth. If suits or garments are made of wool cloth without sponging, they will shrink when they are pressed. Consequently, all wool cloth should be sponged before it is made into clothing, whether the sponging is carried out in the mill or in a special sponging plant.

To test shrinkage in sponging, take a smooth sample which measures at least 20×20 in. Mark off three 18-in. lengths in the warp direction, and three 18-in. lengths in the filling direction. Use indelible ink or sewing thread to mark off the distances, which should be at least 6 in. apart. Dip the sample into water at about 80 F, and then wrap it in a clean towel. Now dry the sample in a current of air on a flat perforated surface. Then dampen the sample and let it stand for 5 min. Finally, press the sample until it is dry. The original lengths of 18 in. can now be measured, and the shrinkage can be calculated.

Shrinkage Tests for Cotton Fabrics

66. In testing wool samples for shrinkage, we were concerned only about steaming and pressing. However, most cotton fabrics are washable, and so the tests for shrinkage of cotton or linen fabrics must include laundering.

For testing cotton or linen fabrics, you need samples of the same size and with the same markings as those used in shinkage tests for wool fabrics. Further, you need a small reverse wheel, or a cylindrical washing machine. Use a standard load,

that is, about 3 lb of dry samples, in about 18 gal of water. To make the laundering solution, use a good grade of laundry soap, mixed to running suds. When everything is ready, place the samples in the washer and start it. Turn on the water and steam. Run the water in, to the proper level, and add the soap. Turn off the steam when the water boils. Run the washer 40 min from the starting time. Then draw off the water, but do not stop the washer. Fill the washer again with water, and bring the temperature to 140 F. Run it for 5 min and draw off the water. Once more, fill the washed to the proper level, bring the temperature to 140 F, and run it 10 min. Drain the water and stop the washer.

Remove the samples from the washer. Squeeze the water out, but do not wring. Spread the samples out and dry them on a screen or other ventilated surface. Dampen the samples with a spray dampener and allow them to condition for 5 min. Press the samples on a press machine; or press with a hand iron by raising and lowering the iron, but do not slide the iron. Then measure the 18-in. lengths you marked off, and calculate the shrinkage.

Shrinkage tests are not normally needed on cloth labeled Sanforized. This is a trademark applied to fabrics that have been shrunk by the compressive shrinkage method. The trademark is an indication that the residual shrinkage of the fabric is less than 1 per cent, and that tests for shrinkage have been made by the trademark owner.

Ironing Tests

67. We have already tested how laundering affects colored fabrics. Now let's see about ironing. Dyes should be fast to washing and ironing in fabrics where frequent launderings are necessary: for instance, fabrics used for aprons, denim, house dresses, pajamas, rompers, shirting, uniform fabrics, and blouses. Dry heat will change the shade of some colors, but the original color will return when the material has cooled.

For testing, moisten a sample of the material. Place it over an ironing board and press with a hot iron until it is completely dry. Compare this sample at once with a material that has not been ironed. Note whether or not there is any change in color on cooling.

For another test, moisten a piece of white muslin and place it over the sample. Press until the muslin is dry. Note whether the color suffers any alteration, and whether there is any smudging of color onto the muslin. If there is no change, or if the original cast, color, or shade returns when the material has cooled, this particular color is said to be fast to ironing or hot pressing.

How to Use This Text

68. Unless you have an exceptional memory, you'll not be able to remember everything you have read in this instruction text. However, the material is so arranged that you can easily find any item you may need. Keep the text where you can find it when you need it in the years to come. The examination questions at the end of the text are designed to give you practice in using the text for quick reference.

Answers to Problems

Answers to Problems in Art. 35

1. Test the stain if you don't know what kind it is. Test the cloth if you don't know what fibers it contains. Test the solvent on a hidden place of the garment to be sure it doesn't dissolve the dye.
2. So the stain can be moved out of the cloth instead of having to go through the cloth.
3. This gives the dissolved stain a place to go. Otherwise you will just spread it around.
4. Otherwise you'll flood the stained solvent. It will travel with the solvent and form a ring.

5. To counteract any tendency of the stain to spread.
6. The solvent will contain a little of the dirt that formed the stain, and a faint stain will show after drying if the solvent isn't removed.
7. To hide any possible rings cause by dissolved sizing or finishing materials.
8. It stops the remaining traces of solvent from spreading and causing rings.

Answers to Problems in Art. 36

1. When the stain doesn't yield to solvents.
2. Test the action of the chemical on the cloth before you go to work on the stain.
3. The moisture will help to spread the chemical and to flood out the staining matter.
4. Because with one long treatment the chemical may get dry, and the stain settle more than ever on the fiber.
5. It must be rendered harmless by neutralizing. For example, an alkaline chemical can be treated with a slightly acid solution, called a "sour" in the trade.
6. Moisten the material and scrape the ring gently; then dry the material quickly.
7. Because the absorbent cannot soak up dry matter. Only after the stain is in solution can it be absorbed.
8. If the absorbents are not worked over, they will stain; and the staining matter would concentrate in the lowest layer of absorbent and remain in contact with the cloth.
9. Absorbents can't harm the fabric, but they are slow in sucking up all traces of the stain.

You'll notice that these answers are not worded in the same way as the text matter you studied. Some of the answers are not taken right from the text material, but are simply logical conclusions drawn from the material taught. This will give you some idea of the answers you are expected to submit in the examination. Your answers should show your instructor that you have not only read the text, but also thought it over and drawn logical conclusions from the material you have studied.

Textiles: Care and Testing

Serial 5883 Edition 1

Examination Questions

Notice to Students.—Study this instruction text thoroughly before you answer the following questions. Read each question carefuly and be sure you understand it; then write the best answer you can. You will profit most if you answer the questions in your own words. When you complete your work, examine it closely, correct all the errors you can find, and see that every question is answered; then mail your work to us. DO NOT HOLD IT until another examination is ready.

1. Suppose that you are to remove a grass stain from a bright yellow satin fabric. What will be your most important consideration in selecting a suitable stain-removing agent?
2. A dry cleaner has cleaned a garment with chemical solvent, but it still looks dirty. What should the dry cleaner do?
3. Suppose that you have to clean a beige coat made from a wool and dynel fleece. The coat is trimmed with brown leather buttons and with brown velvet collar and cuffs, and it is lined with a bright plaid sateen lining. You have tried your regular solvent on a piece of the fleece inside a pocket, where it wouldn't show if anything happened. However, the fleece doesn't appear to be harmed by the solvent. Are you now ready to go ahead with dry cleaning?
4. List three dry-cleaning solvents that will not burn or explode.

5. You want to bleach a white worsted jacket that has white cotton lining. Would you use chlorine or peroxide for bleaching? Explain the reason for your answer.

6. Suppose you sit down on a park bench where someone has deposited a wad of chewing gum. When you discover the gum, it is firmly imbedded in the seat of your pants, or skirt, as the case may be. What can you do to remove the gum?

7. You have three garments to be mended. In garment A, a 1-in. cut has been accidentally cut with a penknife. In garment B, a small pinhole has been burnt by a match. In garment C, an area about $\frac{1}{2}$ in. wide and $\frac{3}{4}$ in. long has been destroyed by moth damage. Which method of mending will you use in each case?

8. A clothing manufacturer produced medium-length pants, called pedal pushers, used mainly by teen-agers for riding bicycles. Within a few weeks complaints came in by the hundreds: the seat of the pants rubbed through after riding a bicycle for a few days. Briefly explain what should have been done to avoid this trouble.

9. Do you think that the microscope would be a suitable means of distinguishing the difference between (*a*) cotton and linen? (*b*) wool and Vicara? (*c*) nylon and glass fiber? Briefly explain the reason for your answer in each case; that is, describe what these fibers would look like under a microscope.

10. Black skirts and white blouses seem to be always popular. The most common complaint with such an outfit is that the black dye of the skirt rubs off on the white blouse. How should the skirt material be tested to avoid this problem?