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Developments in Appliances Which Might Influence the Detergent and Textile Industries

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Abstract

The interrelation of researches in detergents, appliances, and textiles is discussed, showing how a major development in one industry can force reactions by the other industries. Several new appliance developments, which might affect detergents, include a water softener built onto a washer and two novel washing systems. The possibilities of a home dry-cleaner are reviewed, as are appliance industry reactions to the development of permanent-press fabrics by the textile industry. Some predictions about the washing machine of the future are presented.

EACH WEEK AN ESTIMATED 54 million women in these United States pile an estimated 1.3 billion pounds of dirty laundry into home washers. They add detergent, bleach, bluing, ammonia, water conditioner, borax, and sometimes even vinegar to the machine, then push a button, and walk away. Forty minutes later they come back and remove their clothes and inspect them. If they like what they see, jobs are secure, until tomorrow. If they do not like the results they have obtained, someone is going to get hurt. There is a law to prevent double jeopardy in legal cases, but, in our industries, multiple jeopardy is the rule by which we live or die.

In the appliance industry, and possibly the detergent industry as well, there was formerly a tendency to regard the role in the home-washing process as being narrowly defined. The job was merely to supply a mechanical package, into which the customer packed someone else's water, another's detergent, another's fabrics, and still another's soil. Such diversity of source materials could result in complete success only in a few, isolated cases. Looking back to those days, it is nothing short of miraculous that all of the basic industries have achieved such complete acceptance in the market place and that today the clientele is generally pleased with the services performed for them.

A marked change of philosophy, indeed, a rather dramatic change, has permeated the appliance industry. Fig. 1 shows our present concept of the home laundry process and the role played by other commercially interested parties. No longer does the appliance industry confine itself to that segment of the pie labeled "Mechanical Package." As this figure indicates, the washing process is a system to be besieged in a methodical manner. The failure of one interconnected component can result in failure for all.

Because of this recognized interdependency, our laboratories some years ago authorized W. C. Powe to investigate the nature of tenaciously bound soils on cotton garments. Powe's results are well documented within the Journal of the American Oil Chemists' Society, where he has published the majority of his papers. His experiments have taken a respect-

INDEX

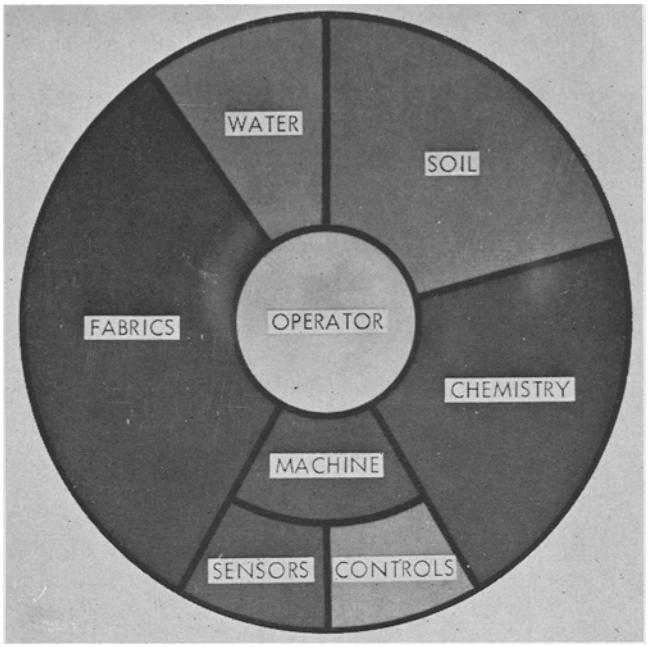

FIG. 1. Appliance-industry concept of home-laundry process. Fabric maintenance system.

able bite out of that section of the pie labeled "Soil," but much remains to be done. Powe's work continues and, no doubt, there will be more of his papers in the future.

Good research, such as this, is useless unless a pragmatic evaluation is made of it, and from this evaluation comes a product or product modification designed to utilize the derived information. The cycle illustrated in Fig. 2 was developed by W. L. Marple as a direct result of Powe's efforts. Proper use of this Super-Wash cycle makes possible a system of two separate washes for heavily soiled clothing while full automation is maintained for the housewife. Results minimize soil redeposition by maintaining at all times a proper ratio of detergent to removed soil.

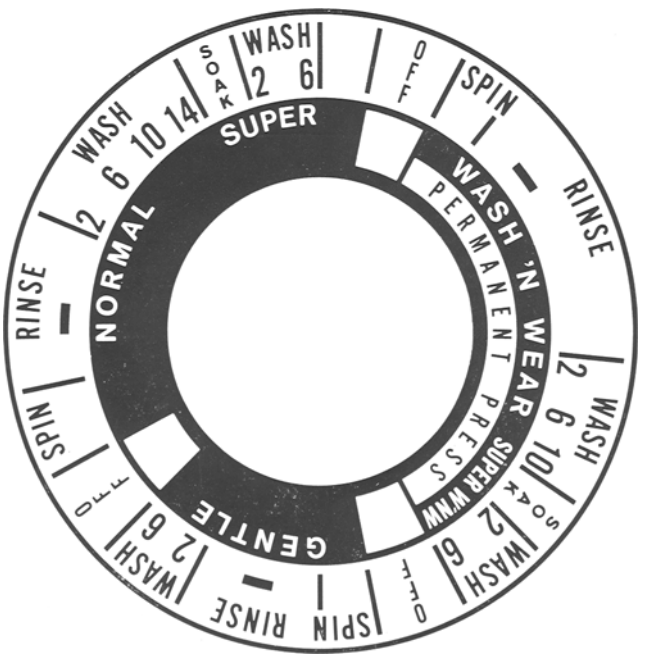

FIG. 2. Stylemaster of washer dial, showing "super" or extended-period wash-cycle.

But this venture into a second slice of pie has not really brought the appliance industry into direct contact with research conducted by others. To do that, we have had to move into more segments. Probably the most outstanding example of interindustry cooperation has been the simultaneous evolvements of permanent-press garments and the necessary home laundry equipment to give proper treatment to them. Prior to the introduction of permanent-press garments in 1964, our textile people were in constant contact with the researchers working in the forefront of this textile-process improvement. The outcome was that properly sequenced, permanent-press wash cycles appeared within a short time on our machines after trade introduction by the textile industry.

The cycle diagrammed in Fig. 3 shows the results of our work. Although there are certain people who are in disagreement, we have found that, for optimum cleaning, which is the first criterion of laundry evaluation, hot water is needed. Hot water however can impart serious wrinkling to those fabrics containing thermoplastic fibers, which presently constitute the bulk of permanent-press fabrics. For this reason it will be noted that twice during the latter part of the wash cycle we pump out one-half of the hot, soil-laden water and add back clear, cold water. This serves the purpose of reducing the water temperature below the critical setting temperature of the thermoplast; thus, on subsequent centrifugal extraction, no permanent wrinkles are set into the garments by the high-gravity spinning. Through use of this cycle we have been able to realize end-of-total-cycle, permanent-press ratings of one-half to one point higher than ratings obtained without water cool-down. There is also a secondary benefit of better rinsing by using this cycle.

This alone was not sufficient to take full advantage of research on permanent-press fabrics however. To what advantage is it to have clean, unwrinkled garments delivered from the washer if dryers are not properly designed to produce wrinkle-free results? The textile manufacturers compensated for this need for larger dryers by simply advocating that smaller loads be dried. This suggestion was and is a good one for those customers already owning prepermanent-press dryers, but again the appliance industry had to redesign machines to compensate for these new, high-performance garments and home furnishings.

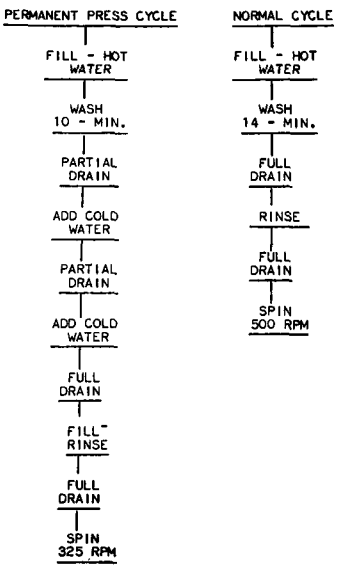

FIG. 3. Whirlpool permanent-press washing-cycle.

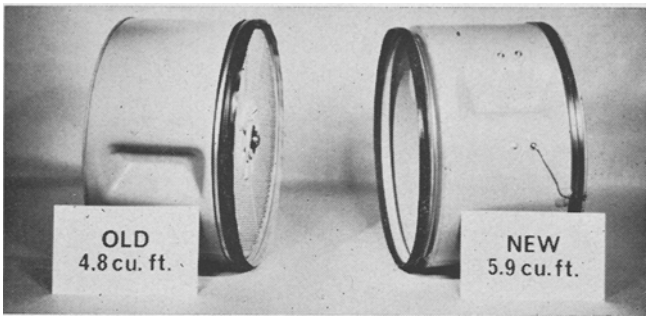

FIG. 4. Dryer drums, old and new, showing increased volume for handling permanent-press garments.

Our approach to the problem is shown in Fig. 4. In these machines, which constitute the major part of our present production, approximately 20% has been added to the volume of the drying cylinder without major additions to the exterior dimensions of the machine. Thus the customer has available an appliance capable of doing larger loads of permanent-press garments acceptably without major alterations to her home laundry facility. An added benefit is the ability to dry permanent-press sheets and tablecloths acceptably. Here added dryer volume is a definite advantage because of the bulk of the fabric.

This example of a systematic approach to a new technology is probably the best evidence to be offered in defense of the new philosophy prevailing in the appliance industry. Without full cooperation and trust between these two different areas of interest, it is likely that permanent-press garments would not be the mercantile success that they are today, nor would home dryer sales have increased approximately 20% last year.

It is not newsworthy that hard water contributes a negative influence in the home laundry process. The AOCS has been in the vanguard of those who have contributed to the alleviation of this problem. The Society's work with polyphosphates, and more recently with such chelating agents as nitrilotriacetate salts, has helped immeasurably with the solutions to the problem. There are however limitations to the process of adding chemical sequestrants to hard waters. The solution would be to install mechanical water-softeners, or even demineralizers, in each home so afflicted. Since this requires a major capital investment which all home-owners are not willing to make, the appliance industry has designed, and has in production, an alternative method to assure improved water quality.

Fig. 5 shows a machine to which we have added a small mechanical water softener. It consists of a flow-through type of canister which holds a cation exchange bed of about 2,100 grains capacity. Results are typical of those obtained when a full-scale softener is installed in the home system, that is, marked improvement in detergency. This device, in 15 grain waters, requires regeneration after every third cycle, which is accomplished by the usual method of flowing a brine solution through the resin bed.

Our industry is peculiar among those represented in this short course in that, to bring a new product to market, great periods of time and large amounts of money are required before the first unit is assembled. It is not a simple matter even to change the knobs on products since design, tooling time, tooling costs, and production-line change-overs are expensive. The first model of a new machine may cost up to $10 million. This is somewhat more than most consumers are willing to pay. The innovations being presented, with the exceptions of the increased-volume dryers and the water-softener, fall into the less expensive category of modifications to existing tools and fixtures or changes in purchased parts.

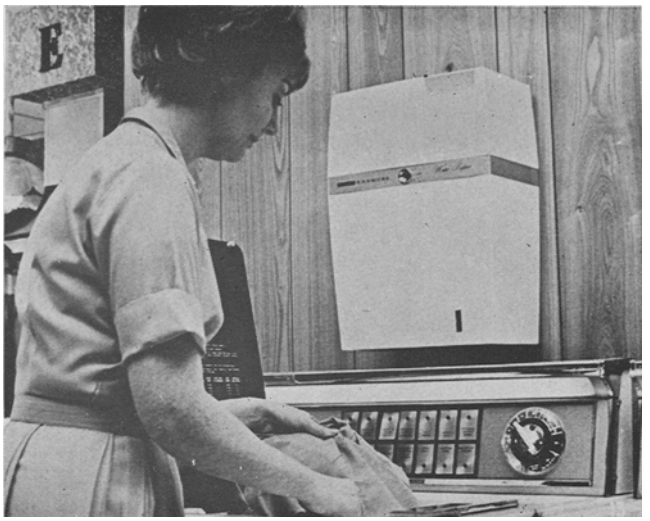

FIG. 5. Water-softener installed on Sears Kenmore washer.

There are many other modifications in process, such as bleach and fabric-softener dispensers, improved lint traps, etc. These are all to be referred to as reaction products. The product improvements have been made generally in response to some outside stimulus, such as researches of others or to our own researches. They are normal, evolutionary changes, not revolutionary. It has always been the goal of our industry to be active rather than reactive, and it is reasonable to expect that from research and develop-

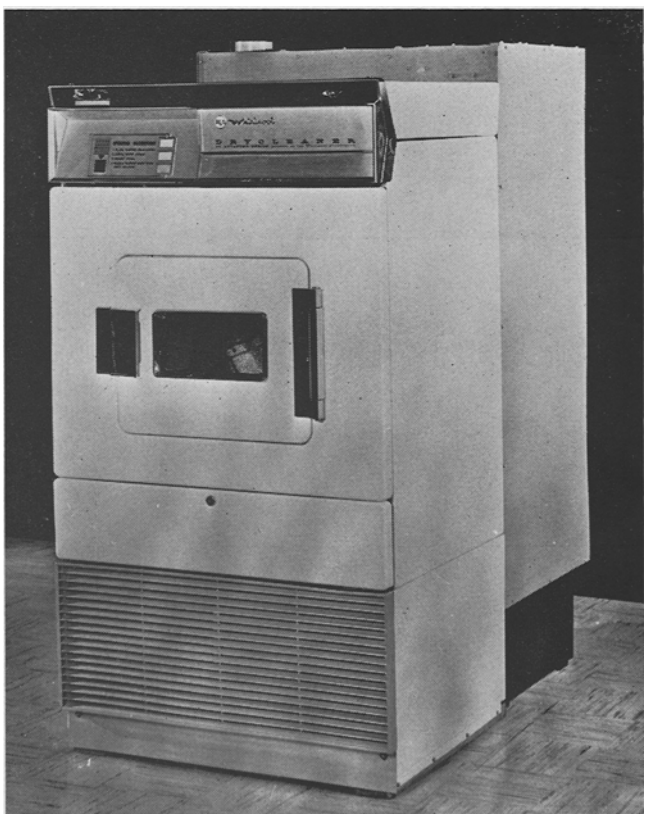

FIG. 6. Coin-Op dry-cleaner.

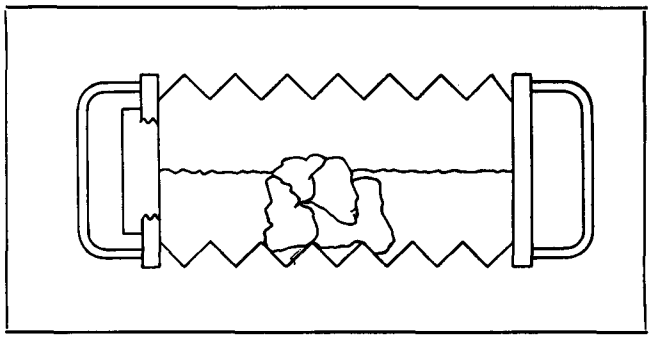

FIG. 7. Accordion principle hand-washer.

ment areas there will emerge certain innovations which will materially affect other groups.

The new laundering device or lab result which is today a mere gleam in some engineer's or scientist's eye might, tomorrow, change various product concepts. What would happen, for example, if suddenly a truly successful home drycleaner was introduced by a major producer or by several major producers simultaneously? Certainly there would be some consternation among the polyphosphate producers and some serious re-evaluations made by detergent manufacturers.

First, is this device a practicable one? Fig. 6 shows a typical coin-operated drycleaner made for commercial installations. It was originally designed to sell for about $3,000. So the answer to the first question is "yes," such a device is practicable. It is possible, by today's mechanical technology, to produce a home drycleaner with a dealer's floor-price far below the cost of the coin-operated machine. If this is so, what is keeping such a machine off the market?

The answers to this question lie not in our particular competence but elsewhere. First, in the past, the health authorities have taken a dim view of drycleaning done at home because of the alleged toxicity of the commonly used chlorinated solvents. Michigan health authorities, for example, stated several years ago that such a machine would have to be a vapor-tight device, which must be installed within a vapor-tight room either separate from the dwelling or in a specially vented room within the dwelling. Instead of a mere machine installation, possession of such a device may require a complete house remodeling. Nor do the safer fluorocarbon solvents fully satisfy the objections of medical authorities since anesthesia and suffocation problems may still remain. Hydrocarbon solvents are out. Again there is an area where inter-industry cooperation is needed to make a new product possible. In this case, mechanical technology must await developments in chemical technology. The appliance industry has acted, instead of waiting to be acted upon.

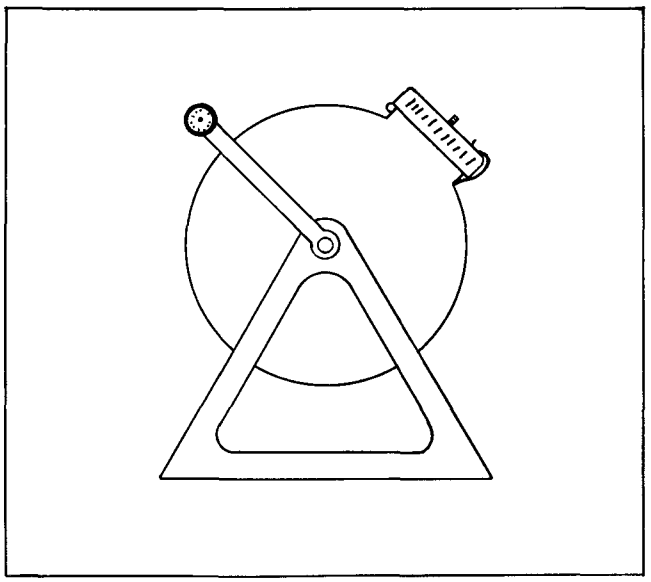

FIG. 8. Compressed air-washer.

The next figures are to enlighten those not wholly familiar with some of the various mechanical devices in use in today's washing machines. Fig. 7 is the Lawrence Welk special, a collapsible, accordion-like bellows into which water, detergent, and a soiled shirt are placed. The soap is jiggled back and forth a few times and, voila! clean laundry. Fig. 8 shows the pressure-release model. After water, detergent, and clothes are added, this device is sealed and air is put into the system with a bicycle pump. The tumbler is rotated at a given rate for a given time, then the pressure is released suddenly by unsealing the lid.

These figures have been included for another reason also. They are designed to show that imaginative thinking is going into the creation of new wash-systems, and although neither of these designs is anticipated to reach record sales, there are other equally unique systems which might.

One of the first questions always asked by groups outside the appliance industry is, when will the ultrasonic washer become a reality? This development still holds our interest. With an ultrasonic washer, energy is imparted to the wash solution by the vibration of barium titanate or similar transducer elements geometrically arranged for the best utilization of the generated sonic energy.

What of the future of this type of machine? Unfortunately, it cannot be said that it will ever be available on the market. As of this moment, two factors militate against it. First is the high cost. Mechanical energy can be imparted to wash solutions through rotating drums or oscillating agitators in a more efficient manner and at much lower cost. The second major objection is the use life of a transducer element. Although these parts have been dramatically improved, they still do not compare in longevity to gear boxes and agitator blades.

The ultrasonic washing machine will become a reality only when these two objections are eliminated and an increase in efficiency is accomplished. Until such time our interest will not cease, but it will diminish. The diminution will be to the point of just keeping a constant watch on the field for new technology. The same can be said about other such scientific novelties as lasers, masers, and fluid amplifiers.

In what direction, then, shall the home washers of the future progress? It is impossible, at this point in time, to sketch what that machine will look like. There are however certain predictions about the composition and performance of that machine which can be made with reasonable accuracy. First, and probably foremost, that machine will use water as the soil-removal and transport medium. No other medium has yet demonstrated that it can dissolve, emulsify, or solubilize the quantity and variety of soils that water can. The very abundance of water militates

against its displacement by synthetic materials regardless of present or future water costs.

There will however be a gradual decrease in water quality, to be expected and compensated for either in detergent formulation or by attachments to washers. It might be necessary to extrapolate the little water-softener to include a second ion-exchange bed which accomplishes demineralization. Mechanically this is a simple step, but certain service problems are bound to arise from it because of the acid-alkali regeneration currently necessary for de-ionizers.

The washer of the future will be expected to deliver less toxic wastes to disposal facilities. This assumes that conservation forces will continue to win their campaigns against pollution of ground waters, streams, and lakes. Here, most certainly, a combined effort of the detergent and appliance industries will be necessary. It will be the function of scientists in the detergent field to make available surfactants and builders which are innocuous to wild life; and it will become our function to assure that a minimal amount of these pollutants are delivered to sewage-disposal plants. Perhaps a clean-up system somewhat like that used on today's drycleaner will be needed.

Another detergent necessity will be proper surfactants, builders, and brighteners for synthetic fiber fabrics. As a colleague in this short course has indicated, this is the fastest growing segment of the textile economy. W. L. Marple of our laboratories has been working in the area of soil release from textile surfaces. He has been able to show that demonstrable differences exist in the soil-removing capacities of various surfactant and various builder types. He is evaluating removal of fatty soils rather than particulates, and his works show some basic needs for the future. New, fat-removing surfactants are needed and will be most important in any future washing machine.

Some recent work points to the necessity for proper sequencing of the addition of surfactant and builder ingredients. If this proves out, it might become necessary for the washer of the future to have several dispensers programmed to deliver individual detergent ingredients at the proper times during the cycle.

The introduction in recent months of soil-releasing finishes for textiles and their subsequent improvement will probably serve to simplify our task somewhat. As these finishes become more effective, lower hot-water inputs will be required for proper detergency and probably also a lowered level of mechanical-energy input. There will remain however a variety of textile materials which require hot water and vigorous agitation. Since the machine of the future will be required to handle both sets of conditions, the soil-releasing treatments will be handled in a special cycle just as in permanent-press garments today. Thus the machine will remain multicycle.

The multiplicity of cycles could lead to the use of a low-order computer into which instructional inputs will be made in respect to the fiber being washed, degree of soiling, weight or volume of load, and type of finish on load, to cite a few possibilities. The machine would then deliver the proper amount of water, freed of polluting ingredients, at the proper temperature to wash the stated load. Washing assistants would be delivered from reservoirs at properly sequenced times of addition. The water will be modified to conform to pollution requirements before it is dumped into the sewer. And, finally, the load will be dried in the same cylinder to the proper moisture content for maximum iron-free performance.

FIG. 9. Recent articles on paper garments.

The machine will be constructed, to a great measure, from materials currently in the research area. Plastics and other polymeric materials will play greater and greater roles in its construction. Controls will be completely electronic in nature with remote control possible from any point in the home. Too, the washer will be designed to blend harmoniously with other decor in the home, and color changes will be possible to permit frequent painting of rooms if desired by the housewife of the 1980's. Noise will be minimal.

The description of the washer of 1980-plus is predicated upon one assumption, that is, that during the 1980's we will be washing fabrics of similar structure to those we wash today. Fig. 9 shows a cloud which could obscure the horizon. Here is a new group which might have to be accepted into our midst. Whether or not paper will take a sizable portion of the exclusively textile garment trade remains to be seen, but there are previous examples to judge by. Whatever happened to the handkerchief? the kitchen hand-towel? the napkin? Are diapers going this way now? Where will it end? All of these must remain, for the time being, rhetorical questions, but certainly the answers, as they develop, will be followed avidly by all of us.

The washer must await these future developments. Perhaps the "washer" of the future will be nothing more than a tumbling cylinder made of art gum, which will erase dirt from paper garments. But regardless of what the future holds, the mutual cooperation of all industries concerned with clothing maintenance must continue; for only through a mutual attack on common problems can the full satisfaction of the homemaker and the futures of our respective employers be assured.