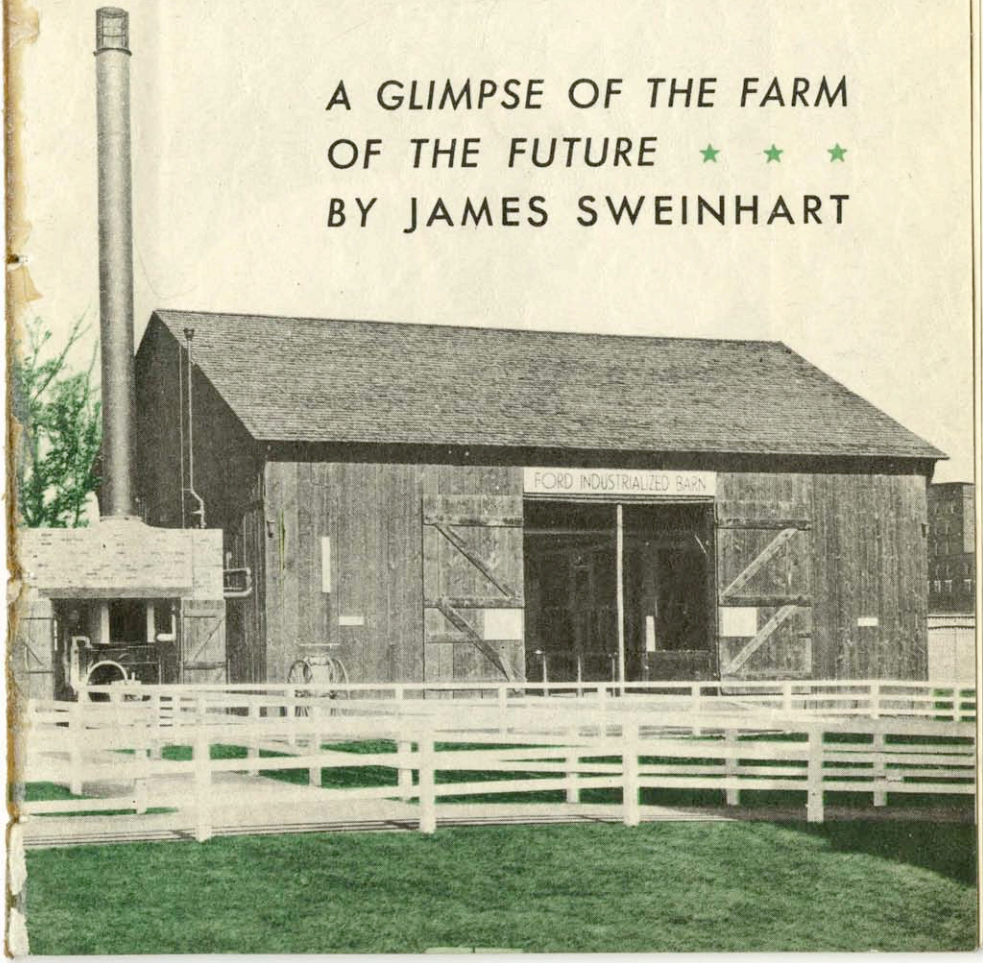
The Industrialized American Barn

A GLIMPSE OF THE FARM OF THE FUTURE ★ ★ ★

BY JAMES SWEINHART



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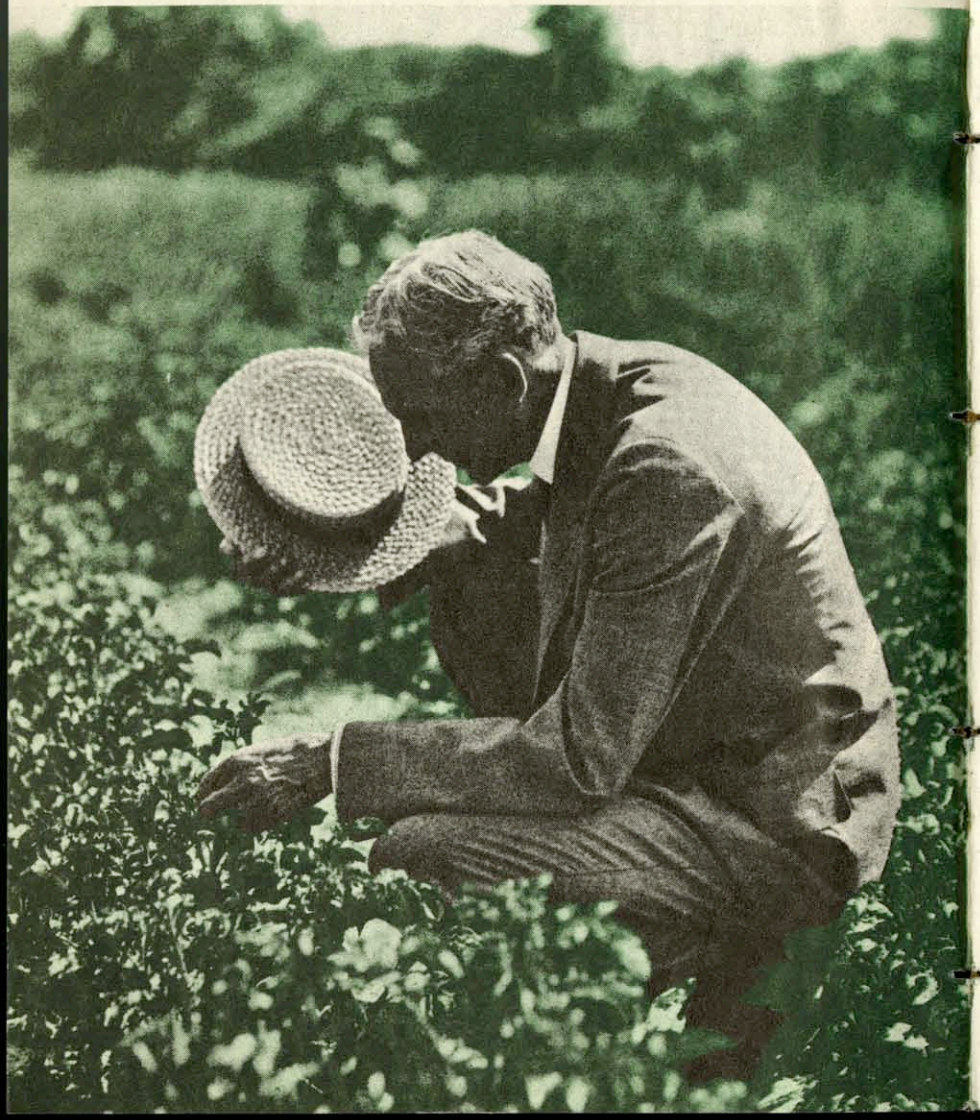

Henry Ford inspects a soybean patch

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A THOUGHT FOR THE FARMER TO WORK WITH

BY JAMES SWEINHART

"I BELIEVE that industry and Agriculture are natural partners. Agriculture suffers from lack of a market for its product. Industry suffers from a lack of employment for its surplus men. Bringing them together heals the ailments of both. I see the time coming when the farmer not only will raise raw materials for industry, but will do the initial processing on his farm. He will stand on both his feet—one foot on the soil for his livelihood; the other in industry for the cash he needs. Thus he will have a double security. That is what I'm working for!"

Henry Ford

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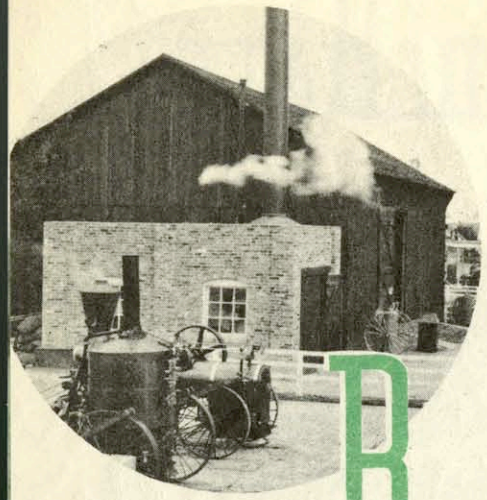


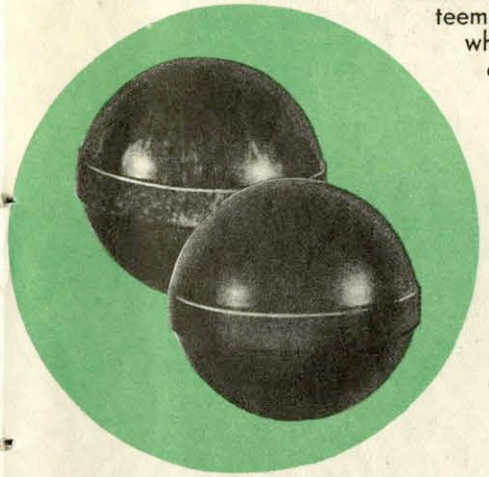
The Industrialized Barn

BEFORE the broad doorway of the "industrialized American barn" which nestles in the shadow of the great Ford Exhibition Building at the Century of Progress Exposition, Chicago, Industry stood talking with Agriculture. ⚜ Henry Ford, world industrialist, producer of automobiles on a titanic scale, had dropped in at the Exposition a few days before it opened to inspect what was being done in the old barn of his boyhood to solve a problem very close to his heart—the so-called "American farm problem." About the door stood a group of corn, wheat and dairy farmers, watching, listening. Farmers and industrialist exchanged views. ⚜ And they talked with understanding—all were farm-born and farm-raised; all knew farm operation from close personal experience—not from books—and all were forward looking. ⚜ They were speaking of changes which the future is bound to bring to American agriculture—of the coordination of the farm with industry; of the coming place of the American farmer, both as an industrial supplier and as an industrial worker; of the necessity of bettering the financial condition of the farmer and his family; of making it possible, for him, with greater income, to attain for his family a greater share of the benefits and comforts

of life. ⚜ It started in a friendly sort of way when a farmer inquired the purpose of the old Michigan barn, filled with machinery, set down in a patch of growing soybeans at one of the busiest spots in the whole, great Fair. A guide had told him that the barn, built in 1863, the year of Henry Ford's birth, originally had stood directly across the road from the house in which Ford was born in Greenfield Township, now the City of Dearborn, Michigan. For seventy years it had been used as a hay-barn. Then, this spring, Mr. Ford had it carefully taken apart, transported to Chicago and there erected again, just as it had been in Dearborn. The oddity of the exhibit aroused the man's curiosity. Quite naturally, he asked the REASON of it all. ⚜ "Yes," Mr. Ford replied, with a smile. "There is a reason behind the old barn's being here. We of the Ford organization are just trying to give the American farmer a new idea to work with. ⚜ We, too, have been thinking—and have come to the belief that the soundest step, and the first great step, that must be made, in this country, for the general good of all our people, is to 'help the American farmer improve his economic condition,' as the professors and experts call it. In plain talk that means to show the farmer how he can operate his farm so that it will yield him and his family an abundant livelihood and, on top of that, bring him a cash surplus with which to buy the things that he and his family need and want and which they can't raise on the farm. I'm satisfied that, once the American farmer sees how he can better himself, he will better himself." ⚜ The farmers asked questions, Mr. Ford answered, and, among other things, he told them: ⚜ "Business is only exchange of goods. If we want the farmer to be OUR customer, we must find a way to become HIS customer. Back at Dearborn, apart from making automobiles, we are in the farming business on a big scale. So, here in Chicago, we are talking as one farmer to another. And the old barn here is our Speaker—it tells the story. ⚜ "What we call the 'farm problem' must be solved by each farmer acting for himself. Just as soon as the individual farmer can make money, the 'farm problem' will vanish for good—and we think most of our other economic problems will go with

it. ⸸ "The vital question is: 'How can the American farmer increase his income?' We think the answer is for him to bring his farm and his labor into a closer relationship with industry. We've been experimenting along these lines—trying to find a way to do that. By means of this old barn—and there are thousands of barns just like it all over the United States—and the simple machinery in it, we are trying to pass along what we've learned for the benefit of any farmer who cares to make use of it. ⸸ "I think we are not far from the time when any farmer, or group of farmers, who are so minded, may begin, on a scale within their means, to manufacture, on the farm, or in a nearby village, products which industry will buy. A great general market does not exist today—that takes time to develop; but there are signs that a market is developing and it is our belief that, once the demand starts, it will be broad and general. ⸸ "Our experiments, to date, have shown that, from soybeans, grown on our own farms, we can extract oil, which we use in the enamel on our cars. From the residue, after the oil is taken out, we have found we can make steering wheels, timing gears and other parts. The old barn shows how it can be done with machinery which most any farmer can rig up at home from odds and ends. It proves beyond dispute that materials that can be used in making cars can be grown on farms—thus saving our mines and forests. And we've only started—we are continuing to experiment with other things. We're satisfied that materials for other parts can be grown on farms if only sufficient thought is put to it." ⸸ But there are many other things in the Ford exhibit. The Ford Exhibition Building in itself is a marvel of modern structural and lighting technique. Mr. Ford was eager to see these, too. So he took leave of his fellow-farmers and passed on into the big exhibition building. ⸸ Ford's first experiments to bring the farm and industry closer together were made in a laboratory in connection with the Edison Institute, at Dearborn, in 1930. Prolonged analysis and processing of various crops common to the American farm proved that oils, proteins, carbohydrates and fibres of value to industry could be developed—the problem remained of finding some material and developing

some process that, together, could be operated profitably. ⸸ In these experiments several tons of wheat were used. Also several thousand bushels of carrots, sun-flowers, the seed of which has a high oil content; cabbages, onions and corn-stalks. It was not until December, 1931, that, after a long series of experiments with the soybean, Mr. Ford and his chemists felt they, at last, were approaching solution of the problem of finding a basic farm material from which the ordinary farmer could develop a commercially profitable product. ⸸ The attributes of the soybean which attracted the chemists are the same as have made it for countless centuries the major diet of a vast part of the world's population. How far back man began to cultivate the plant no one knows—one authority estimates 25,000 years. Certainly, it was cultivated and highly valued as a food in China and Japan for centuries before written records were kept. One of the earliest instances of its being mentioned is in the Chinese remedy book, or materia medica, written by the Emperor Shen Nung, 2838 years before Christ. The fact that the soybean contains double the amount of protein and calories as is found in beefsteak explains why it has been, for upwards of one hundred generations, the principal source of protein in the diet of the peoples of Eastern Asia, how they can endure the hard manual labor to which their teeming millions are accustomed, where they get their mental virility and how they came to develop a high state of civilization when the inhabitants of Europe and the two Americas were still barbarians. ⸸ It was a New England clipper ship, back from trading along the China coast, that, in 1804, first brought soybean plants to the United States.

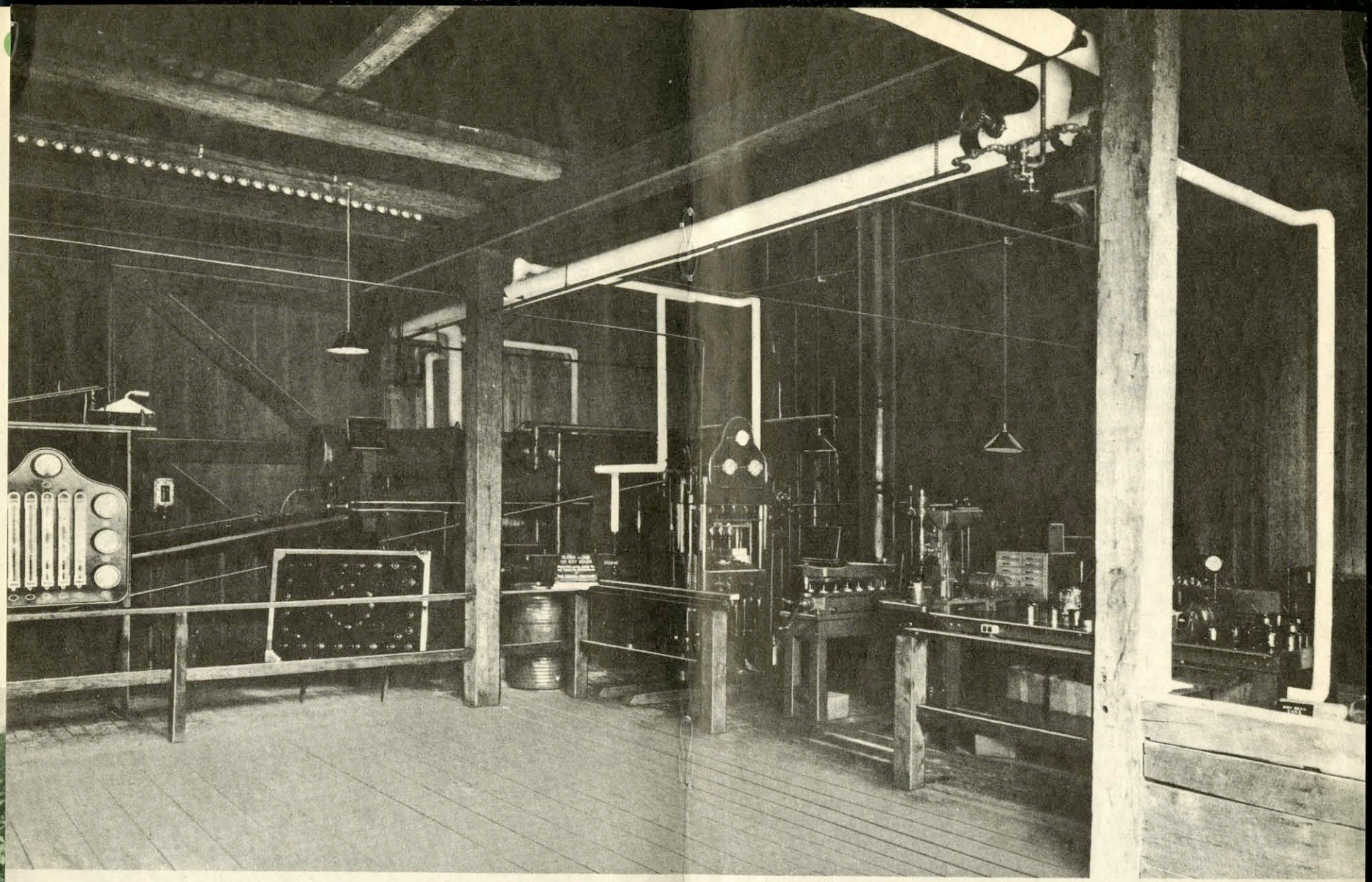


Gear Shift Knobs

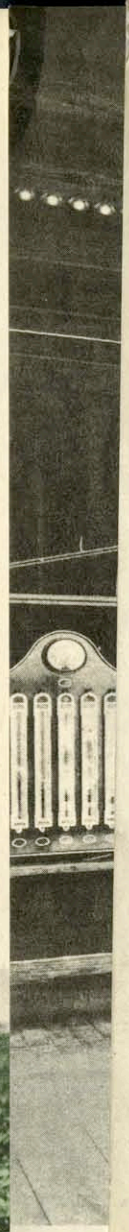
Physicians, dieticians and others who would like to see the soybean a part of the American diet are not discouraged by the fact that acceptance of the plant and its cultivation in America came very slowly—after the Spanish Conquistadores had taken home to Spain and planted a strange vegetable which they had found in cultivation by the natives of Chile and Peru more than 300 years elapsed before the potato had come into general use throughout Europe. It is felt that with modern publicity methods and the public's more intelligent interest in and appreciation of food values but a very short time should be required for the soybean to find general acceptance throughout the world—because it has five times the caloric value, twenty times the protein value and two hundred times the fat value of the potato. ⸸ Although cultivation of the plant in the United States remained practically stagnant for more than a century, the last 30 years have seen a great upspringing in the growth of the soybean. It can be grown satisfactorily in any climate suitable to corn or cotton and is now grown generally over the Eastern half of the United States. Thirty years ago but eight varieties were grown in this country, but, today, growers and seedsmen handle more than 60 varieties. Twenty years ago there were less than 500,000 acres of soybeans under cultivation in the United States—today there are more than 3,000,000 acres. Most of the large increases are in the Southern and the North-Central corn

A Bumper Crop

states. ⸸ Centuries of use of the soybean by man have proven these three facts: 1—Cultivation of the plant builds up the soil by bringing nitrogen to it, rather than deteriorating the soil as many crops do. 2—The soybean can be used as a highly nutritious food by man and beast, and, 3—It contains oil and other products which are coming to have a commercial and industrial value. ⸸ Mr. Ford's interest in and cultivation of the soybean as a part of his efforts to bring prosperity to the American farmer will undoubtedly prove a great stimulus to the growth of the soybean generally throughout the United States and parts of Canada and Mexico. His introduction of the use of soybean oil, and of its pressed fibre, in his own industry is expected to stimulate general use of the products of the plant throughout American industry. Last year Mr. Ford had more than 7400 acres planted in soybeans, on his huge farms in Lenawee County, Michigan, yielding approximately 100,000 bushels. During 1932 and 1933 he expended approximately $1,225,000 on his soybean experiments and his work along this line is continuing today and represents one of his closest personal interests. ⸸ Everything pertaining to an automobile has its origin in the Earth. There is no need, as Mr. Ford sees it, to exhaust the mines and forests if the material required can be grown on the farm; and, in addition, the growing of the material on the farm will give to the farmer, when markets are developed, another source of cash. When the industrial market for farm products has been developed, as Mr. Ford sees it, it will not be long before there appears the farm-factory, in which much of the processing, by which the product is advanced into better condition for the market, will be done right in the fields where the soybean is harvested, or as nearby as possible. ⸸ This would mean that two sources of security—instead of one—would then be open to the American farmer; the farm, which he has now, and industry. For several generations the people of the United States have considered the one and only function of the American farm to be to supply the American dinner-table. Up to the early years of the present century that was approximately true—because the American home consumed practically all that the



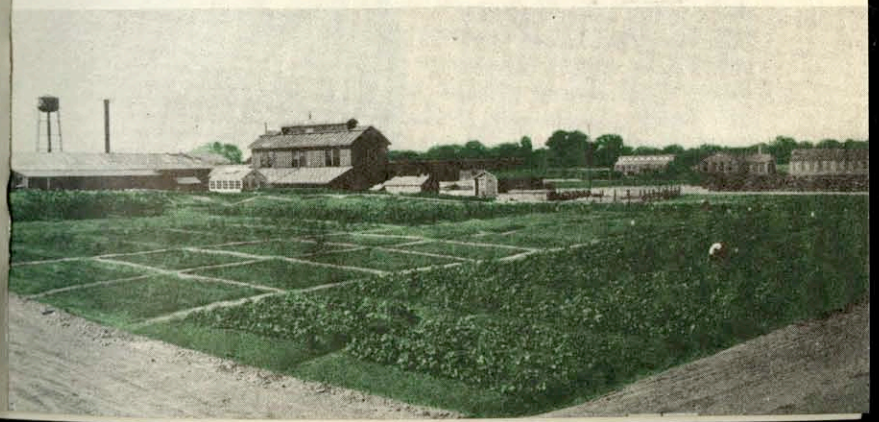
Interior of the Industrialized Barn at the Ford Exposition



American farm produced. But more recent years have brought a huge problem, ever pressing for solution and, until solution comes, growing steadily worse. That problem lies in the fact that, with the growth of the country, the development of great, new farm areas, the introduction of new, tremendously efficient farm machinery and more intelligent planting and handling of crops, the aggregate American farm today produces far beyond what the aggregate American family consumes—a situation made doubly acute by a faulty monetary and distributive system that prevents millions who want from buying. ⸸ And, perhaps, the deepest evil of the whole situation is the fact that among the millions who want, but cannot buy for lack of money, are millions of the producers—the American farmer and his family. ⸸ Mr. Ford believes that much of this economic misery can be eliminated, by far the greater part of the problem solved, by a better adjustment of our national agriculture to our national industrial activities; that is, to create an economic system by which industry will consume to a very large degree the surplus produce of the American farm over and above the needs of the American dinner-table. Mr. Ford does not condemn surpluses. He believes they are good in that their existence, and the necessity of eliminating or reducing them, forces us to study new ways of using the products of the soil. The greater and more general the use of the products of the soil the greater the opportunity for the farmer to increase his financial income and improve the economic condition of himself and his family. ⸸ Such a system, Mr. Ford believes, would work a benefit of incalculable magnitude not only for the farm population of the United States but for the population of city and town as well. On the urban side of the problem such a system would do away with the gathering of large populations in so-called "factory towns" with the congestion and evil social conditions incident thereto. It would also prevent much of the social dislocation which always follows industrial depressions. ⸸ Under such a system we would no longer think of industry and agriculture as separate activities—each would be a reciprocal, functional, cooperative part of our whole national productive enterprise.

As agriculture would begin to feel the benefits of industry, there would arise a tendency to ruralize industry by a process of decentralization which will restore to literally thousands of our smaller towns and villages much of the employment which has been taken away by the lure of the great industrial centers. The use of the soybean and its products in industry is but one of a thousand mediums for a union of agriculture and industry. There is no end to the possibility of industrial-agricultural adjustment along these lines. ⸸ The incidental selection of the soybean by Mr. Ford for his illustrative example of a little of what can be done if the intelligence, genius, and love of achievement of the American farmer and industrialist are cooperatively joined and applied to our greatest national problem, came about because of the simplicity and readiness of the demonstration and because it involves no problem that an ordinary American farmer cannot master with his own means at hand. ⸸ The uses to which the products can be put in American industry today are manifold. A broad market is not yet developed in this country—but it is not far away, Mr. Ford believes. It will probably be ready as quickly as the American farmer can gear himself up to supply it. There is abundant opportunity for the use of many soybean products in the making of automobiles alone—for such uses as enamel, foundry sand-cores, horn-buttons, steering wheels, gear-shift knobs, distributor parts, light switch assembly and

an Experimental Station at Greenfield Village



timing gears. For centuries, in China and Japan, soybean oil has been used in making soaps, various kinds of glues and adhesives. In France, Germany, Belgium and Holland, huge quantities of soybean flour are used both in baking for public consumption and industrially in the making of special foods for animals. In Europe and Asia products of the soybean have long had widespread pharmaceutical use. Here in the United States use of soybean oil is already beginning to find a place in the manufacture of glycerine, house-paint and enamels of many different kinds. One of the secrets of the lustrous, lasting, hard-wearing finish on all the Ford V-8 cars is the fact that soybean oil was used in its production as part of Mr. Ford's effort to create a new means by which the American farmer can increase his income. ⚜ In addition to all this the shredded stalks of the soybean can be used industrially as fibers in making boxes, pressed board, wall materials; as fuel, and in the making of certain chemicals, among them furfural. ⚜ The purpose of Mr. Ford in exhibiting his "industrialized barn" is to show the millions of American farmers attending the Exposition how simply the initial processes of manufacturing soybean products can be done right on the farm, at home. ⚜ The first step after harvesting and drying the beans is to break them up and extract the oil. In the Orient the sole method used for extracting for centuries past has been by means of pressure. But this has never proven very efficient—even with the best results something like 30 per cent of the oil was left in the bean mass. In Europe and this country other methods have been developed, all of which have certain advantages. The method which the Ford experimenters finally chose after trying all of them and then developed to a high degree of efficiency, involves the use of a solvent which, stated in simplest terms, literally washes the oil out of the crushed bean. On an average it extracts about 95 per cent of the oil. On some tests it has done even better. The oil is then separated from the solvent by distillation and by a simple live-steam treatment all trace of the solvent is removed from the mass of crushed beans. ⚜ There are many barns in the United States, now standing abandoned, that could easily be converted into factories such as is shown at the Exposition. The machinery is simple and easily installed. It can be obtained almost anywhere, at small cost. Much of it is standard piping. ⚜ The process is direct and rapid. Soybeans, after threshing, are stored on the upper floor of the barn where the heat rising from below helps to dry them. Directly under an opening in the floor is a set of rollers, so placed that the beans feed into the rollers by gravity. The rollers flatten the beans into thin flakes and they then pass into the extractor. ⚜ This is a pipe fixed at a 10-degree angle to the floor and filled with a solvent, which is generally a high-test gasoline or naphtha. The bean-flakes are fed into the bottom of the pipe and carried, in a tumbling, washing fashion to the top of the pipe by a screw conveyor, on the order of the Archimedes worm. As the thin flakes work upward against a constant stream of gasoline, practically every bit of oil is removed from the bean and mixes with the gasoline. The flakes, after considerable contact with the solvent, move on up in the form of a meal, to the top of the pipe, where they leave the solvent chamber and drop into a steamer where the solvent which the meal has soaked up is vaporized and driven off by a current of steam. The meal leaving the steamer is granular in form and has no trace of the solvent odor. Meantime the gasoline, fed in at the top of the pipe, works its way down, against the meal, along the flanges of the screw, carrying the oil with it. At the bottom of the pipe is an upright piece called "the neck." When the oil-laden gasoline reaches the bottom of the pipe, atmospheric pressure forces it up into "the neck," from which it overflows, leaving the extractor and carrying all the oil with it. Distilla-

Light Switch Assembly, Horn Button and Coil Case

tion then turns the gasoline into a vapor which rises, passes through a cooling apparatus, is condensed back into the form of gasoline and flows back into the top of the pipe which forms the solvent chamber. Thus, it serves its purpose as a solvent again and again, the whole process working continuously. ⸸ The distilling apparatus is simple. The gasoline, flowing from the "neck" is first put through a filter which removes all particles of meal. Then it is run into the still, which consists of a 12-inch pipe, 16 feet long, the upper ten feet of which are filled with coke. The solution, flowing over the coke, meets a rising current of live steam, which drives off the solvent and only the pure soybean oil remains at the bottom of the still. When the machinery is in operation there are about 100 gallons of solvent in the system, flowing continuously in a closed circuit. As every seam and vent is closed, except one, there is very little waste of gasoline and very small fire hazard. ⸸ By this process 2000 pounds of beans yield approximately 400 pounds of oil and 1600 pounds of meal. The latter contains about 45 per cent protein and the remainder carbohydrates. ⸸ The Chinese early found a use for the bean-meal after most of the oil had been removed. They ate it. When fresh it was found palatable and it lent itself to preparation in various ways involving cooking. But, due to the fact that they could not get out ALL the oil and that, once crushed, the oil in the bean became rancid, commercialization of the meal for human consumption did not extend beyond the lower masses. ⸸ But they also fed both the whole bean and the meal with some of the oil extracted to their livestock and found it very nutritious. Animals thrive on it. The example of the Chinese in this regard has been widely followed in Europe where the oil-free meal is used extensively as a livestock food and conditioner. ⸸ However, Mr. Ford has found another, much more profitable use for this meal. It is going to be one of the principal raw materials for a great new industry which is just getting started. The new industry or art is called "plastics." It consists in molding some suitably prepared

300 Pods on a Single Plant

material or composition, by means of heat or pressure or a combination of both, into hundreds of forms useful in the home or in industry. From the soybean meal Mr. Ford's experimenters have developed a plastic material which, under pressure, molds very solidly, can be finished very smoothly and will take a high polish. The process is too technical to describe here, but the machines used in molding the parts are on display in the "industrialized American barn." ⸸ The field of the new plastic industry offers immense possibilities. Radio cabinets, flooring tile in a thousand different color and form combinations, table tops, brackets and supports of a hundred varieties, buttons, spools and shuttles for the textile industries, ash-trays and cigarette-holders are only a very few of the hundreds of things that are being made today with plastic materials and for which the soybean meal could be made to serve admirably. ⸸ The plant and machinery exhibited in Mr. Ford's "industrialized barn" is a good example of simplicity of design and operation. The oil extractor may appear complicated, but inspection proves that it is made of materials—partly standard piping—available almost everywhere. To add the feed spout and the steaming section requires only a very simple welding operation, which any small shop can do. ⸸ The distilling apparatus is made of 16-gauge sheet metal and can be made in any tin-

shop. The only other piece of special equipment is a filter, which is a conical tank fixed half-way up the extractor pipe. This is of welded construction and could be made along with the extractor. The crushing rolls are the only items that have to be purchased, aside from the few pipe fittings and other accessories needed. ⸸ The power is developed by a boiler and steam-engine. This makes the plant self-contained—as even the electricity and lights are furnished from a belt-driven dynamo set beside the engine. The plant could be set up in any community regardless of the power supply available. ⸸ The boiler used at the "industrialized barn" was chosen because of its efficiency. It is equipped with a steam superheater. The fire-box is unusual in that it permits of the use of several kinds of fuel. It is equipped with a gas-burner here at the exposition for the sake of convenience. Coal, wood, oil or other fuels could be used. ⸸ One advantage of the small mill is that two or three weeks' supply of beans can be stored on the top floors and beans can be brought in when needed—for soybeans can be harvested throughout the winter. By storing beans in thin layers a drying action is obtained by heat rising from the extractor below. This eliminates the expense of a grain drier. The equipment shown here is purely experimental. The Edison Institute is working on a plan to make it even simpler. ⸸ A group of farmers could build and operate such a plant as is here described and such as is shown in the "industrialized American barn." Such an industry would use the farmer's crop and also provide him with employment through the winter. ⸸ Thus, the barn and its process is the expression of a great step toward bringing agriculture and industry more closely together. ⸸ When the soybean is finally developed to its full usefulness in this country and the American people recognize the vast possibilities for their welfare inherent in this plant, it will no longer be necessary to exhaust our mines and forests for materials which can be grown on the farm—and in the supplying of those manifold materials, in immense quantities, when the industrial market for soybean and other plant products is fully developed, the American farmer will find a new independence.