

UNITED STATES DEPARTMENT OF LABOR

FRANCES PERKINS, Secretary

WOMEN'S BUREAU

MARY ANDERSON, Director



Women's Employment in  
Aircraft Assembly Plants in 1942

By

ETHEL ERICKSON



BULLETIN OF THE WOMEN'S BUREAU, No. 192-1

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1942

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 10 cents

336-4  
SERIAL  
FRASER



## CONTENTS

---

	Page
Introductory.....	1
Earlier survey.....	1
Second survey.....	1
Conclusion.....	2
Jobs of women in aircraft assembly plants in early 1942.....	3
Machine operators.....	3
Drill-press operators.....	3
Milling-machine operators.....	4
Turret-lathe operators.....	4
Grinding-machine operators.....	4
Miscellaneous machine operators.....	5
Burring and filing.....	5
Sheet metal and subassembly.....	5
Riveting.....	6
Welding.....	6
Splicing cables and swaging.....	7
Electric assemblies.....	7
Tubing.....	8
Fabric or covering department.....	8
Painting and doping.....	9
Heat treat, anodizing, and plating.....	10
Final assembly.....	10
Inspection.....	11
Store room and tool room.....	11
Other jobs.....	11
Factory clerical and nonproductive jobs.....	12
Supervisors.....	12
Plans for future employment of women.....	13
Training.....	14
Supplementary training.....	16
Rates of pay.....	16
Hours of work.....	17
Personnel requirements, policies, and practices.....	18
Preemployment examinations.....	18
Age.....	18
Marital status.....	18
Uniforms and work-clothing standards.....	19
Tool kits.....	20
Labor unions.....	20
Working conditions.....	21
Food service.....	21
<hr style="width: 10%; margin: auto;"/>	
Aircraft subassembly and parts plants.....	22

# Women's Employment in Aircraft Assembly Plants in 1942

## INTRODUCTORY

### Earlier survey.

In the spring of 1941 a report by the Women's Bureau on aircraft assembly plants pointed out that much of the work of operating production machines, bench work, sheet-metal fabrication and forming, precision assemblies in the electrical, instrument, and tubing departments, the assembly of control surfaces, wing and fuselage parts, and some of the painting, anodizing, heat-treat and plating jobs, factory clerical jobs, and others, could be done as well by women as by men. Seven of the major aircraft assembly plants were visited as a basis for this report in the spring of 1941; three of the seven employed no women and in the others only a fraction of 1 percent of the factory force were women. Most of the women were in the fabric or covering department, with a very small number in the electrical and tubing divisions. The Women's Bureau report restrained its estimate of the possibilities of employing women to roughly one-fourth to one-third of the jobs as suitable for women, partly in view of the uninterested attitude of most employers and the strong preference for men expressed in all discussions of job opportunities, training, and induction of women into their industry.

### Second survey.

In the late summer and fall of 1941, requests were coming to the Women's Bureau from aircraft plants for information on employment standards and jobs for women, and reports indicated that some of the plants—even some that had been most openly hostile to the consideration of women—were beginning to employ them in other than fabric jobs, trying them out in small numbers in the electrical, sheet-metal, and other departments. Foremen were reporting their amazement that women could do as well or occasionally even better than men on light work, and also that men and women could work side by side without completely disrupting factory discipline and production.

A few public vocational schools offering private courses sponsored under National Defense Training and many private fee-charging schools were admitting women to aircraft training. Then, after December 7, the practical consideration of women as a vital labor supply gained momentum and the numbers employed in aircraft factory jobs began to increase appreciably, the numbers of women from October 1941 to February 1942 increasing more than five times, and from October to April increasing more than nine times.

To secure information on the employment of women, their numbers, the work they were actually doing, future plans, employment policies, hiring requirements, and practices affecting women, and to offer coun-

sel and suggestions for the effective use of women in war-production plants, agents of the Women's Bureau, beginning in December 1941 and continuing through the first 3 months of 1942, visited 26 operating aircraft assembly plants and 2 plants under construction. The plants visited are in 9 States, California, Kansas, Missouri, New York, Ohio, Oklahoma, Pennsylvania, Tennessee, and Texas.

Light, medium, and heavy bombers, flying patrol boats, and cargo, transport, observation, fighter, pursuit, interceptor, and trainer planes were being assembled in the plants visited. Six of the plants had been included in the first survey. A total of approximately 250,000 persons were employed in the operating plants, and of these about 70 percent were classed as productive factory workers. At time of visit, women comprised 4.2 percent of the factory force. Three of the 26 plants had no women employed in the factory but may have taken on some women since. The largest proportion of women factory operatives was about 15 percent, or about 1 woman in every 7 workers. More than two-thirds of the women for whom information was secured were in California plants; 5 plants had more than 500 women, the largest number being slightly over 1,200. The numbers of women in war production change so rapidly that they have little value except as indicative of the trend. By April 1942 about 6 percent of the productive workers in aircraft assembly were women.

In the past women have not comprised an appreciable proportion even of the clerical and nonproductive force in aircraft plants, but the Women's Bureau figures showed proportions of office women, white-collar workers, ranging from about 5 percent to 75 percent; two of the smaller firms had more than 70 percent women, with the average for all plants 14.2 percent.

Up to the present the hiring of women in the aircraft industry has been largely to augment an increasing force rather than to replace men. In the past the industry has preferred young men, but as decided inroads on this group are made by Selective Service, women undoubtedly will be recruited in large numbers as substitutes for men.

Due to the many uncertainties accompanying war production, many firms were loath or unable to give a concrete estimate of the numbers or proportions of women in their anticipated future personnel, but the statements of 12 representative plants indicate that by the time peak production is attained the number of women will have increased to six or seven times the number in the early spring of 1942, and upwards of 100,000 women probably will be employed by the end of 1942. California plants may have 25,000 to 30,000 women.

In the second report of the Women's Bureau on the role of women in aircraft assembly the emphasis is on the work that women were doing in the factories, with supplemental information on the training programs, hours and shifts of work, rates of pay, requirements, and policies and practices with reference to the age, marital status, and other personnel matters affecting women.

### **Conclusion.**

Nine times as many women are employed in aircraft assembly in the spring of 1942 as were employed in the late fall of 1941. New jobs that women can perform or to which they can be upgraded are being found almost every day, and women are doing many kinds of machine, assembly, and inspection work. Women have demonstrated

in aircraft that industrial capability is not based on sex and that the line of demarcation for men's and women's jobs is largely imaginary. If women are afforded training for and encouragement in their jobs, a much larger proportion than generally is supposed can be upgraded to fill positions requiring high degrees of skill and responsibility.

## JOBS OF WOMEN IN AIRCRAFT ASSEMBLY PLANTS IN EARLY 1942

Though the over-all proportion of women in aircraft assembly was still small, plant officials' experience with the induction of women had changed many of their ideas of the nuisance value of women workers and lessened their fears and bugaboos that women were inapt mechanically and that it was impracticable for men and women to work efficiently side by side. Some of the foremen who had expressed a presumptive opposition to the induction of women in their sections were among the most effusive in their praise of the quality and quantity of the work done by women under their supervision, and were even willing to admit its equality to that of men.

Women were observed working on most of the manufacturing processes that go into the fabrication and assembly of an airplane, and were found on all the operations suggested as suitable for women in the 1941 report of the Women's Bureau. On some jobs there were only a few women in a few of the plants. Women were seen scattered through many departments as operators in the machine shop; fabricating and forming sheet metal; doing detailed and precision assembly in electrical, radio, instrument, tubing, and cable departments; building up minor and major assemblies of control surfaces for the wings, fuselage, empennage, and final assembly; welding; working with plywood, fabrics, and soundproofing; helping in paint, heat-treat, plating, and anodizing departments; inspecting; working in tool and store rooms, and as part of the factory planning, clerical, and messenger services.

### MACHINE OPERATORS

A considerable share of the operation of production machines, though calling for varying degrees of skill, requires but little strength in handling parts and setting up machines; this comprises such work as drilling, milling, small lathe work, hand screw machine or turret-lathe machining, grinding, profiling, and so forth, and is possible for women. In only about one-third of the plants, and to small extent in these, were women assigned to the machine shop as such, but many machines of the production type are used in other divisions, such as the sheet-metal, metal-fittings, and assembly departments. The machine tooling and die departments require skilled mechanics who can do original and varied work to a high degree of accuracy, so women do not, and at least for the present cannot, fill many of the labor needs of this type.

#### Drill-press operators.

More women are employed on drill presses than on any other machine work, and they are drilling on all kinds of small metal parts, castings, extrusions, and fittings of aluminum alloy, sheet metal, and steel. To drill a hole is not difficult but to drill in the exact spot and

to the exact size requires skill. Women are employed on jig and sensitive and on single and multiple drilling. On sensitive drilling—usually light work—the operator must have a sense of feeling what the drill is doing as it spins and pushes its way through metal. In one plant where a woman operating a sensitive drill was pointed out as a recent substitute for a man the leadman explained that on her first day this woman exceeded her predecessor's production of approximately 500 parts, though he had been employed for months on the job, and that she has since maintained a daily output of double his record.

Women not only were boring holes but were working on all such drill-press applications as reaming, countersinking, counterboring, tapping, spot facing, key seating, burring, and lapping holes. Where it was customary for drill-press operators to change and sharpen their own drills, the women usually were doing this. A few women had full-time jobs dressing the points and grinding the cutting surfaces of drill tools to specified angles and shapes. In addition to the operation of stationary drill presses, even larger numbers of women were operating portable electric drills and screwdrivers on bench and floor jobs as a part of or preparatory to assembly. Personnel administrators and foremen in numerous instances commented on the skill and ease with which women adjusted themselves to drilling. A truism seemed to be, the women are as good as men at drilling.

#### **Milling-machine operators.**

The progression in machine operating for women appeared often to be from jig drilling to sensitive drilling, and then when the operator had attained skill in sharpening and changing her drills, if she worked in a production shop she might be upgraded to the operation of a milling machine. Sometimes girls coming from defense classes had been placed directly on milling machines. A smaller number of women were seen on milling machines than on drill presses. Girls loaded the machines and some were setting up the work to blueprints and checking with precision measuring aids. Milling machines usually are operated by easily manipulated button and lever controls. For light repetitive work of slotting, grooving, and so forth on small and medium-sized parts, women are well adapted.

#### **Turret-lathe operators.**

A somewhat smaller number of women were operating hand screw machines or small turret lathes (these machines are practically identical), making screws and small cylindrical parts that are needed in quantities but not sufficient to set up an automatic screw machine. Successive turning, boring, reaming, facing, and like operations are performed rapidly without removing parts from the machine and much of the work is repetitive. Set-up men adjusted the machines and tools for men as well as for women. The operation of hand screw machines or turret lathes on small work is not beyond the ability of women who have had enough experience or training to acquire some mechanical aptitude, a familiarity with the characteristics of metals, and cutting speeds.

#### **Grinding-machine operators.**

Small parts that had been machined on lathes, milling machines, planers, or shapers were further machined by women on magnetic chuck surface grinders and other rotating grinding machines. Women

grinders were able to follow blueprints, measure with calipers, micrometers, and scales, dress their grinding wheel if necessary, and generally follow work specifications. There were no large numbers of women on grinding, but foremen and instructors in training classes stated that light grinding was an especially suitable job for women and one with definite upgrading possibilities for those with experience on other machines such as drill presses and milling machines.

### **Miscellaneous machine operators.**

Band saws, hack saws, nibbling machines, and profilers were operated by women in a few instances. Also, some women were using wire bristle wheels to clean metal parts or to remove scale, and were doing light polishing with rag (fabric-covered) wheels.

In a few plants making trainers where plywood is being used in place of sheet metal, women were employed on wood-working machines, sawing, sanding, gluing, nailing, and finally assembling the parts into structural sections of the plane.

All the plants that employed women on metal-working machines expected to assign more women to such work, and others were becoming accustomed to the idea of women on machine operations and were considering them for their factories.

## **BURRING AND FILING**

A favorite introductory job for women is burring and filing in the machine shop and metal fabrications departments. Rough edges, small projections, and irregularities are removed from machined parts, fittings, casting, and sheet-metal parts with emery cloths, burring tools and files, the work sometimes being to close dimensions along scribed lines. Larger burrs or surplus metal are machined off on lathes and stationary grinders and the insides of holes are cleaned with burring attachments on drill presses. Many women were on bench burring and filing and as an entry job it afforded them training and experience in the use of hand tools and clamps, scribing, the handling of metals, and sometimes templates and machines, as well as breaking them in to the noise and work environment of the factory. Men have never been kept on burring jobs when opportunities for promotion came, and it is to be hoped that it will be considered an introductory job for women also.

## **SHEET METAL AND SUBASSEMBLY**

Sheet-metal fabrication includes a wide range of jobs and a series of operations in all aircraft assembly plants, and most of the plants had women employed in the forming, reworking, and assembling of parts from sheet metal. Burring and drilling are common jobs here. Many parts are first formed on large drop hammers and a few women have been reported as assisting in the tending of these hammers and hydraulic presses—placing and taking off the parts. More women were observed on the hand forming or straightening of small parts over wooden blocks, using fiber or rawhide mallets. Women were forming curved sections on small rolling machines, were using hand and power brakes for bending, and were cutting sheet metal with hand snips and power shears. Women were employed only on the lighter forming, the smaller sizes of brakes, shears, and rollers. On light- and

medium-sized punch presses they were blanking, forming, and piercing small angle brackets and fittings. Women also were scribing lay-outs from blueprints and templates for machining and assembling.

Operations preparatory to assembly, such as lining up in jigs and fixtures the ribs, spars, cowl flaps, struts, panel boards, tanks, and many other fittings used in the structure of the plane, included women in their number on both bench work and floor assembly. Women as bench workers using small jigs were forming subassemblies, fitting parts together with hand tools, wrenches, screwdrivers, scrapers, and the use of arbor or power presses to force the parts close together, drilling holes with portable drills, cutting with hack saws, inserting screws, clips, and dimpling by hand and machine.

Women were working with men on plexiglas parts for cabins and bomber turrets or compartments, laying out and scribing the work by the use of templates, heating the transparent plastic in special ovens, forming it over molds or in presses, and finishing and trimming the edges with band saws, milling machines, and grinders. After forming, the parts usually are covered with paper (masked) to protect the surface until the final assembly has been completed.

### **Riveting.**

Riveting, the assembly operation that builds up most of the sub-assemblies and final assemblies, is the most publicized job in aircraft and the one for which much of the preemployment defense training has been given. One company contemplated taking on 2,000 additional women riveters. Women were engaged on the jobs concomitant with riveting—drilling, dimpling, inserting Cleco clips, and clamps for riveters—and as teamworkers were driving rivets with pneumatic guns and bucking rivets, operating one-shot and multiple stationary rivet presses, portable one-shot riveters, and squeezer riveters. Women were reported as shooting explosive rivets in spots that were difficult to reach with other equipment. Though not in large groups as yet, women were on all the varied types of riveting and not only were working on jig subassemblies of ribs, spars, and bulkheads, but were attaching the metal skin to the control surfaces and wing panels, and were crawling around inside and underneath the fuselage as riveters. Small women are found especially suited to riveting and bucking inside cramped spaces such as the empennage. Apparently riveters are always in demand and experience has shown that women can fill a substantial part of the labor force on this type of work.

### **Welding.**

Women welders are not so numerous as women riveters. There are not so many jobs for welders as for riveters in aircraft, and a great deal of specialized training has been given and required for welders so that Army and Navy tests and standards can be met by the operatives. Private aviation fee-charging schools have enrolled women welders and public schools have trained women where employers have requested such training. Though the proportion was small, a few full-fledged women welders were seen manipulating acetylene torches and welding rods joining brackets to steel tubing on engine mounts, tanks, landing-gear parts, and other parts. A woman welder being paid a journeyman's rate of \$1.32 an hour was reported as one of the most efficient in the group with which she worked; the others were men.

Parts plants making manifolds, cowls, airscoops, and tanks were employing women gas welders. Beginning women welders usually were started on tack welding—the temporary putting together of all parts prior to final assembly—and on welding parts not subject to strains that require the highest-grade welders.

Spot welding, a process that is substituted for riveting on an increasing number of assemblies, requires little training and women were being employed with marked success. A young girl spot welder who had more than doubled the previous production records of boys on the job was pointed out by one foreman. The spacing of the weld, the regulation of the pressure on the material, the welding time, and the flow of electrical current usually were reported as duties of leadmen but might be done by women if they are given the supplementary instruction needed and some knowledge of ohms law. Finger dexterity is helpful in spot welding and very little of the work requires heavy lifting. A few women who were spot welding and who talked with representatives of the Women's Bureau were most enthusiastic about their work.

Electric arc welding is replacing torch welding on some operations. No women were employed in the plants visited, but instructors and foremen reported that women could be used on the lighter operations if trained.

#### **Splicing cables and swaging.**

In the cable department of one plant several women were preparing assemblies of light cable, cutting to length, splicing, selecting the proper fittings, soldering, crimping, and operating swaging machines that shape and shrink the ends of tubing, and pressing metal fittings on the ends of cables. Two women who were working in the cable department in one plant were interviewed. They were cutting cables and swaging. Before their present jobs they had been in more usual woman-employing industries—stores and restaurants—and found their present work less tiring and much more interesting. One of them said that her foreman had considered splicing too hard for women, but she had watched the men and gradually was allowed to take over some of the work.

#### **Electrical assemblies.**

For many years electrical companies have employed large numbers of women on bench jobs doing precision assembly, so it was to be expected that among the first occupations deemed suitable for women in aircraft production would be some of those in the electrical workrooms. Jobs that women were working on were the assembly and preparation of electrical systems by cutting wires, attaching fittings and lugs with screwdrivers, arbor presses, and soldering wire to contact points; laying out wires on routing boards or jigs, bending them around pegs until a complete harness is assembled, and then lacing groups of wires together with wires, strings, and tapes, shellacking a protective covering, installing them in flexible conduits, soldering on lugs, and attaching designations for the final assembly into the plane.

The wiring and assembly of switch, junction, jack boxes, and work on the instrument panels were other woman-employing operations. Illustrative of the work done by women in these departments are some

of the operations that comprise the assembly of the instrument-panel board. The sheet-metal panel, junction box, name plates, instrument supports, valves, electrical connections, reinforcing angles, shock mounts such as rubber cushions, and other components are brought together. Parts may need slight reworking to secure an accurate fit of brackets, boxes, and fittings, and women were grinding, burring or filing, reforming with mallets any surface irregularities, and drilling and preparing additional holes needed for alining with the jigs and templates. Holes were alined in the various parts, and instruments such as the altimeter, tachometer, and turn and bank indicator, with their supports, were fastened in place with clamps, screws, bolts, and rivets. Fittings such as metal tubing, hose, valves, switches, knobs, and handles were attached according to specifications, and the women were using pliers, hand and pneumatic wrenches, peens, and other light tools. Short lengths of tubing were threaded into valves, indicators were adjusted, and pressure lines tested by women. The adjusting and checking of the instruments after the installation in the panel board was done by men in all plants at the time of the visit, but with training and encouragement for job progression, women could be developed who could do these more technical operations.

Most of the work in the electrical, radio, and instrument-panel divisions required manipulative dexterity of a high degree and the use of light tools. Much could be done at alternating sitting and standing work postures. In all ways it seems especially desirable for women and it is a type of work in which women's place should be assured not only for war but for normal production. Foremen several times stated that men had been "bored" by these jobs with a resulting high turnover or careless work.

### **Tubing.**

A large bomber has thousands of feet of tubing for fuel, oil, oxygen, de-icer fluids, instrument and electrical conduits, and so forth. The inside of an aircraft wing or a fuselage is a maze of copper, aluminum alloy, and steel tubing. Women were being employed in increasing numbers on all the operations in the tubing departments. They cut tubing on hack saws; burred tubes inside and out; bent them by hand or machine for correct alinement to attachments; attached connectors, elbows, sleeves, unions, couplings, and so forth; flared tubing either by machine or by hand tools; cleaned, blew out, tested, capped, and marked it with identifying bands of different colors or color combinations to indicate its use and installation. In several of the large aircraft plants women were the majority group in the tubing department and were employed on all the operations that have been listed.

## **FABRIC OR COVERING DEPARTMENT**

In most plants the fabric or covering department was the first to admit women, since a good share of the work is of a needle-trade character. Twenty-one of the twenty-three plants employing women had women on their fabric work. In one of the plants an assistant supervisor of the fabric department had sewed and stretched the fabric covering for the first planes turned out by this factory in the first World War. In most plants only the movable control surfaces are

fabric covered and in some even these are metal skinned, but in the trainer assembly plants wings and sometimes even the fuselage are still fabric covered. Cutting covers for control and other surfaces, taping the framework, machine stitching, stretching and pinning the covers to the framework, hand sewing the unstitched openings with close and evenly spaced baseball stitches, and rib lacing with long needles or rib staying the fabric fast to the rib structure by inserting flexible rods or special screws, are the usual occupations of women in the covering department.

In addition to the coverings for control and other plane surfaces, the fabric departments employed women to cut and sew a variety of covers for special accessories. In bomber plants women were making the lay-outs, using blueprints and templates and cutting various kinds of soundproofing and insulating materials such as stone felt, Dry Zero, kapok, and asbestos, taping, and inserting fasteners and grommets. For large transport planes and bombers women were making canvas curtains, upholstered pads, cutting and finishing carpets and other upholstered and fabric accessories. In at least a couple of instances women were observed as they cemented or glued the soundproofing to the interior fuselage surfaces, trimming edges to secure an accurate fit and pressing the material to the airplane skin according to specifications. Women also cemented insulating covers on steam lines, hot-air ducts, and other pipe lines or tubing.

The general competence and productive skill of women in the fabric or covering department seems to have been demonstrated sufficiently so that their place in this type of work is accepted without comment and is largely taken for granted. Much of the work requires dextrous fingers and strong hands. Considerable skill is required for lay-out work and the guiding of electric cutters on heavy materials.

### PAINTING AND DOPING

Up to the time of the survey only about one-third of the plants employed any women in their doping and painting divisions. Masking—the covering of parts with tape, paper, or special coatings as a protection during painting or against damage during installation—was one of the most common jobs for women in the paint shop. Women were loading belts for machine painting, hanging small parts on racks for spraying and removing and inspecting them when dry. Insignia, numerals, and other special designations were sprayed on with the use of stencils or by applying decalcomania transfers, and occasionally women were employed for this. There were, also, a few women reported on brush priming, cleaning of painted surfaces, peeling off and removing masking, and doing any touch-up painting needed with small spray equipment.

Applying dope to fabric surfaces to make them taut and waterproof was done by women in a few plants, but usually was limited to extra coats of dope brushed over the tape reinforcements on ribs of the control surfaces.

An entry job for women in the paint and plating departments was the preliminary cleaning of small parts and surfaces to remove grease or other substances that would affect the adhering.

## HEAT TREAT, ANODIZING, AND PLATING

Women's jobs in the heat treating, anodizing, and plating operations were few in number and limited in duties. The numbers employed in these departments are small and there are probably few desirable jobs for women. Often ventilation is a problem because of steam, heat, fumes, and smoke from plating and anodizing baths and furnaces. Burns from splashing hot liquids, chemicals, and furnaces are a hazard and sometimes toxic, and a considerable share of the work entails heavy lifting. The only jobs on which women were observed were the cleaning of small parts, stringing them together with wire pins, hanging them on racks, covering threaded parts with special coatings such as asbestos cement, uncracking, and assisting with tending small furnaces for the heat treating of rivets, quenching, drying them on centrifuge machines, and then storing them in refrigerators.

## FINAL ASSEMBLY

The proportion of women on the major fuselage and wing and final assembly lines was very small. Most plants had no women on these lines. In a couple of plants, however, women were working underneath and alongside slowly moving assembly lines installing pulleys, pulley brackets, pedals, levers, radio tables, seats, switch panels, controls, and fastening bonding strips and cables in place temporarily for final fastening by the rigger. Some of the women pushed themselves along with the plane on small rolling platforms, installing the parts assigned to their section, and then rolled back to the next plane on the line.

Women were assisting in the installation of tubing, taking off caps that had been placed to protect the tubes from dirt and foreign particles, blowing out the lines with compressed air, and attaching the tubing to fittings inside the fuselage and wing sections. Another job on which a few women were assisting was the installation of engine cowls, fastening cowl parts with Djus fasteners, and checking and adjusting ventilating flaps.

Women were noted also as working in a group or team installing parts of the hydraulic system for landing gears, fitting valves, cylinders, threading wire through nuts and bolts, and putting in final place other light parts of the hydraulic mechanism.

Mounting fittings and accessories as power-plant assemblers was the only work on which women were noted in the installation of the engine in the airplane. Final installation of plexiglas cabins, fitting and gluing soundproofing to the interior of the fuselage, and screwing, bolting, or riveting small accessory fittings and furnishings in the interior were reported as occasionally done by women. Workers on the final assembly lines need considerable all-round ability in using all types of hand tools, following complicated blueprints, for a variety of operations and working in close collaboration or teamwork with others on the line. As more women gain experience in the subassembly and fabrication division, their employment on the final assembly line will become increasingly feasible.

## INSPECTION

Women inspectors were employed in at least one-half of the plants. They were engaged chiefly in the checking to order specifications of incoming purchased parts such as valves, rivets, bearings, and clamps. Threads, angles, and tapers were measured and gaged by women. Women inspected small parts and castings for internal defects, operating Magnaflex testing equipment. Testing the hardness of metal on Rockwell, Brinnell, and scleroscope testers required close attention to detail and constant repetitive work. Foremen stated that men were apt to become bored with this type of work and that women had proved much more satisfactory on the inspection of all kinds of small vendors' goods. In the course of inspection women used all the usual types of inspection aids, micrometers, calipers, scales, and gages.

During the fabrication, forming, and assembly, inspection is continuous along with the processing. Women were employed on inspection in departments where they constituted a substantial part of the group, such as the fabric, electrical, and tubing sections. Also, in the paint, heat-treat, and plating departments, women were inspecting small parts and stamping or otherwise designating parts that met the required specification. Numbers to designate parts for assembly and replacements were put on by stamping or stenciling, electric etching needles, or machine or hand marking tools.

## STORE ROOM AND TOOL ROOM

Store and stock rooms had women employees in the majority of the plants visited. Supplies such as sheet metal, extrusions, bars, clamps, nuts, bolts, rivets, and parts are kept in bins and on shelves and racks. Many of the parts to be stored and issued are small and can easily be handled by women. Much of the work is of a semiclerical nature, keeping stock records of the receipt and disposal of parts, perpetual inventory reports, filing requisitions and orders.

Similar jobs were held by women, and more could be held, in the tool rooms, where tools, templates, small jigs, and dies are stored, maintained in condition, and issued. Only a small number of women were found in the tool rooms, but in all cases where there were women it was planned to augment their numbers. If women had a more general mechanical background and knowledge of the names and uses of tools, more might be considered as desirable tool-crib workers. One firm estimated that it might use almost 300 additional women tool-crib attendants and clerks if labor supply conditions made it advisable.

## OTHER JOBS

In one firm women were learning gage building. One girl was working on an electric strain gage and her job involved the threading of tiny hairlike wires. Deft fingers and the ability to work with painstaking accuracy on small details were attributes praised by the supervisors.

Girls in San Diego were receiving training in plaster-form making and it was expected that before long some women would be employed as assistants on plaster-form and template making.

Miscellaneous jobs on which some women were observed or reported were chiefly of a service nature in the factory, such as elevator operators, sweepers and janitors, oilers, operators of interdepartment electric trucks for transporting parts, office and factory messengers on foot and on bicycles—in one case called “rover” girls. One plant recently reported the use of women as police guards. None of these are significant in mass job possibilities but they suggest the many-sided types of women's present activities.

### FACTORY CLERICAL AND NONPRODUCTIVE JOBS

Factory clerks in aircraft plants in normal times were almost all men, and at the time of this study men still were the preponderant group. As would be expected, women are steadily coming into the factory clerical jobs as substitutes for men in larger numbers, but the influx seemed to be chiefly in the typing, stenographic, and general factory clerk activities. A small number of women were employed as production clerks in planning and control divisions but preference still was for men. Few women were timekeepers. Experience has demonstrated that women can serve as stock- and tool-room clerks, as has been noted, and more may be employed as the labor market is further depleted of men. With the increase of women on the force, it seems a natural sequence that the number of women in personnel administration should increase.

Training courses have been established to train women as scientific and engineering aides. A few women engineers—an average of less than one to a plant—were pointed out, and an occasional woman was making architectural or prospective drawings of new plane models and parts. Drafting aides—tracers and letterers—had a few women representatives. Women with some engineering training or mechanical-drawing ability and a mathematical background were reported as possibilities for engineering aides to draw diagrams for parts. In the weight-control and stress-analysis divisions of engineering, many mathematical computations are made and a few women have been admitted to the ranks, but many more women who have a background in mathematics and short courses of special training in aerodynamics should find opportunities for war-production jobs. Girls who in their schooldays had a flair for descriptive geometry, trigonometry, and graphic projection methods should be useful in lofting.

### SUPERVISORS

Supervision of women by women in the aircraft plants is still a moot question. Management often tended to shy off when questioned about the policy toward and possibilities of women supervisors with a statement that women prefer to be directed by, and work better with, men bosses. A few women supervisors were found in fabric divisions and as leadwomen in electrical, small assembly, and inspection, and these were reported as satisfactory. Most women have as yet not had enough experience in the industry to be in a position to take supervisory jobs that require a proficiency in the work of their department and an all-round knowledge of the processes involved. When women have longer work histories, it seems certain that women as well as men can

direct the work of groups. Women who seem likely supervisory material should be admitted to training classes for foremen.

Women counselors as a part of the personnel staff had been appointed in some of the plants to deal with advisory, counseling, and disciplinary problems of women employees and to serve as a clearing house for special problems and grievances of the women and foremen. In some plants matrons were stationed in rest rooms to prevent loitering and to discuss work problems and advise the girls. These women were not employed in the capacity of maids but more as counseling aides.

## PLANS FOR FUTURE EMPLOYMENT OF WOMEN

All the plants visited expected a steady growth in the number of their women employees and the production activities assigned to women. As already stated, the plants that did make estimates of the numbers of women they anticipated employing indicate an increase that may result in at least six or seven times the numbers employed early in 1942.

Most of the plants had no definite formulated plan by jobs as to the numbers of women they might employ in the coming months. One company, with two major assembly divisions, had analyzed by department and plant the jobs suitable for women and the numbers that might be employed, and this plan may be considered illustrative of future woman-employing trends in aircraft assembly plants. Women already were employed in many of the departments but the proportion was considerably under 10 percent. The woman-employing plan of this company was based on its job patterns and employment at the beginning of 1942. Over 12,500 jobs—almost one-third—were considered suitable for women, and a company official reported that both the numbers and the proportion of women to be added might be increased if labor-supply needs required.

Jobs for women were listed in most of the major departments, such as machine shop, metal fittings, sheet metal, precision and detailed assembly, hammer and press, trim shop, heat treat, paint and finish, fuselage assembly, wing, empennage, and final assembly, inspection, tool crib, stock rooms, engineering, experimental, dispatching, intraplant transportation, production and material planning, timekeeping, personnel, service, and maintenance. Two hundred or more jobs were considered suitable for women in each of the following departments: Sheet metal, electrical, tubing, miscellaneous subassembly, fuselage, wing, empennage, final assembly, heat treat, tool crib, storeroom, production control, production planning, and engineering. Machine operators, assemblers, inspectors, and clerks were scattered throughout the departments. In the wing, empennage, and final assembly, suitable jobs for over 3,500 women were reported, and the jobs included machine operations, detail assembly, drilling, dimpling, riveting and bucking, spar and frame building, fitting skins, airplane plumbers and riggers, installers of tubing, cowling, power plant, soundproofing, and so forth. Most of the jobs—almost 2,500, or one-fifth of 12,500 jobs—were as riveters. In sheet metal and subassembly, women were being considered for all sorts of detailed and precision assembly, drilling and riveting in all phases, filing and burring, etching, operating numbering machines, spot welding and welding helpers, press operators, and others,

most of which jobs have been commented on in the preceding pages. More than half of the jobs planned for women were related to riveting and detailed and precision assembly.

A number of more unusual jobs listed for women were airplane riggers, airplane plumbers, millwrights, template makers, weight computers, material estimators, plaster-pattern makers, and instrument testers.

## TRAINING

Company officials in the aircraft industry were not enthusiastically disposed to favor preemployment training for women. Many stated that the bulk of the jobs in their plant to which women were being assigned or would be assigned required no previous training, though they had sponsored and subscribed to preemployment training of men for some of the same jobs. Somewhat grudgingly, however, they admitted that in practice women with preemployment training were given preference when applying for jobs. In most localities public defense schools, too, have not been allowed until recently to admit women to aircraft courses unless their training was sponsored by a defense plant and reasonable assurance of placement of female trainees was given. Fee-charging schools, some undoubtedly good but others very poor, are not restrained by such provisions or scruples and have advertised extensively for women to be trained for riveting, welding, and other sheet-metal work. Many women who desired to train for aircraft have been victimized by high fees and poor training, while some training facilities in public schools in early 1942 were idle because of a scarcity of male trainees.

At least such jobs as riveting, welding, operating some of the machine tools, and precision inspection require definite and closely supervised training whether given in preemployment classes or on the job under foremen and leadmen. Most companies have too few supervisors and facilities for specialized instruction, and much time and material can be wasted in haphazard training of new employees.

In most of the regions where large aircraft plants have been located, few women have worked in the metal industries, and women in general have little acquaintance with tools, properties of metals, and precision tolerances. They are at a disadvantage as regards background and experience when compared to the average man who goes to work in a metal shop. The nomenclature of the shop is a new vocabulary to the girl worker. Terms such as brazing, dolly, contour, dope, fin, oil can, rib, strut, thimble, arbor, punch, dimple, rouge, and so forth have quite different meanings in the factory from those in everyday life; for example, "oil can" signifies a buckling of the metal. The noise, interruptions, and work demands in a production shop often make instruction difficult. Women undoubtedly need more training than most men and recognize this need. Instructors in defense training schools state that women bombard them with questions, are much more meticulous than men in following detailed instructions, are less likely to slur over and pass up specifications, and demand more attention on their training projects. There are many adherents of the idea that women should be given a few weeks of orientation in general shop practice, an introduction to shop mathematics, interpretation of blueprints, measuring tools as micrometers, scales, and calipers, basic principles on the

properties of metals, shop terminology, and some preliminary experience with machines and assembly. Instruction on the job is still necessary but it is much easier for both worker and foreman if a foundation for shop work has been laid by preemployment training in either the factory or a vocational school, and women themselves fit in better if they know how their job fits in with the scheme for the finished airplane.

Several communities in California and a few other States have good public defense training courses available to women and the number of applicants outnumbers the training positions. Many courses have been opened to women for the first time in the spring of 1942. One training set-up for women that seemed especially good was that in the public National Defense classes in San Diego. Twice as many women as men, just over 600 women, were receiving preemployment aircraft training, and a larger number had completed the courses in sheet metal, machine shop, electrical assembly, welding, and inspection. Almost all the trainees who had satisfactorily completed their training had been placed in local aircraft assembly plants, parts plants, or the local naval air depot.

All women enrolled for shop work were given basic instruction in the handling of tools, some knowledge of metals, lay-outs, interpretation of work orders, blueprints, and training in one or more fields to fit them for a definite job as a machine operator, a riveter, a general sheet-metal worker, or a precision assembler.

A course in plaster-pattern making being given to a small group of girls was an innovation, and though at the time of the visit to the San Diego school no girls had advanced far enough for placement, the principal felt that there would be opportunities in local factories for those who completed the course.

Another new course in this school was one for engineering clerks. Girls with some college education and a knowledge of algebra, geometry, and trigonometry were given preference. Trainees in this course were working from blueprints with slide rules, using and working out mathematical formulas, and calculating amounts and weights of materials to be used, and were being prepared to work in engineering offices as weight-control clerks and materials computers.

Reports in the late spring of 1942 announced that Vocational Education for National Defense (VEND) in San Diego expected to train thousands of women for local aircraft factories in the present year.

The Engineering, Science, and Management Defense Training (ESMDT) offered by colleges throughout the country was beginning to offer courses to women as preemployment training for subprofessional jobs in engineering and scientific work, for drafting assistants, for precision inspectors, and for production-control clerks.

Under United States Civil Service certification, women as well as men are being enrolled as mechanic learners for placement in Government air depots as civilian mechanics. Instruction to student trainees is given in National Defense training centers for the following airplane crafts: Engine mechanic, propeller mechanic, instrument mechanic, radio mechanic, electrician, sheet-metal worker, welder, painter, leather or canvas parachute worker, wire worker and cable splicer, hydraulic mechanic, and woodworker. Courses as outlined in California offered from 320 to 600 hours' training. Certified train-

ees are paid \$75 a month while in training and at the end of their training will be assigned as far as possible to work at a depot or sub-depot within the area from which they are appointed.

While all courses, according to the Civil Service announcement, are open to women, women at first are being directed to the parachute, fabric, sheet-metal, radio and electric work, and gas-welding courses.

### Supplementary training.

Supplementary training and upgrading classes were open to women and some had enrolled for blueprint reading and machine operation. As women are upgraded they should be encouraged and advised in the taking of special supplementary training on the same basis as men. Plans for Job Instruction Training (JIT) should give special attention to the needs of women.

## RATES OF PAY

Women are entering most of the aircraft plants on the same pay scale as men. The job and work done, rather than sex, is the standard advocated by the War Production Board, the Army, the Navy, and the United States Department of Labor. Beginning rates ranged from 30 to 65 cents an hour for men and women. Twenty of the twenty-three plants had a uniform entrance wage for men and women, the most usual, 60 cents an hour, being reported by 14, 65 cents by 2, 55 cents by 2, 50 cents by 1, and 30 cents by 1, the last a small and relatively unimportant plant making a trainer type of ship. Of the 3 with wage differentials based on sex, 2 started men at 60 cents and women at 50 cents, and 1 started men at 55 cents and women at 50 cents.

All 9 aircraft assembly plants visited in California had the same entrance rate, 60 cents an hour, for men and women, with a progression of 5-cent steps at 4-week intervals until at the end of 12 weeks 75 cents was reached, the lowest rate for regular unskilled workers. At the end of the 12-week period workers are assigned the rate agreed on by collective bargaining or established by management for the job.

In New York, 2 plants had beginning rates of 65 cents an hour and 1 of 60 cents for women; in Kansas, 2 of 60 cents and 1 of 50 cents for women; and in Pennsylvania, 1 plant started women at 60 cents an hour, 2 at 50 cents, and 1 at 30 cents. In 4 plants in Texas, Tennessee, Ohio, and Missouri, 1 fell in the 60-cent entrance group, 2 in the 55, and 1 in the 50. For 22 of the 23 the range of beginning rates for women was from 50 to 65 cents; the 1 small plant with a 30-cent beginning rate had a production-bonus system and the rate specified was the lowest guaranteed hour rate, with actual hourly earnings considerably higher.

At the time this study was made, women's work history in the aircraft industry was not long enough to have hourly earnings that had progressed much above the beginning rate. The average hourly earnings for women usually were less than 75 cents. Only nine plants reported that the prevailing rates for women averaged 75 cents or more.

The highest-paid woman reported in the shops was a welder receiving \$1.32 an hour. The next highest were two women in covering

departments at 98 and 95 cents. Twelve plants reported maximum rates paid to women ranging from 80 to 98 cents an hour. Since women were still novitiates in the industry, their rates were not typical of the wage plans for women. By the summer of 1942, it is to be expected, many more women will have reached the higher levels in the aircraft wage structure.

A new aircraft plant in the Midwest has announced its minimum rate for all productive workers—no sex differential—as 95 cents an hour. A few of the job rates for occupations on which large numbers of women will be employed are: \$1.10 for light assembly; \$1.10 to \$1.20 for inspection; \$1.15 to \$1.30 for filing and burring; and \$1.10 to \$1.15 for punch-press operating.

Work on the second and third shifts was compensated at rates somewhat higher than the day rates. Five and six cents additional hourly usually was paid, and the third or "graveyard" shift often was a short one, 6½ or 7 hours, paid for as 8 hours with the additional 5 or 6 cents for the actual hours worked.

Most employees, both men and women, were working more than 40 hours a week, and in accordance with the Fair Labor Standards Act received time and one-half for hours worked in excess of 40. Most women were working 48 hours and on the day shift, and on this basis, at a 60-cent beginning rate, their week's earnings would be \$31.20; at 75 cents, \$39.

## HOURS OF WORK

Most of the women in the aircraft assembly plants, as just explained, were scheduled to work an 8-hour day and a 48-hour week, 19 of the 23 plants having such a schedule. One plant had an 8-hour day and a 40-hour week, 2 had a 7½-hour day and a 45-hour week, and 1 had some of its women on a 10-hour day and a 57-hour week.

Four of the 9 States in which plants were visited (California, New York, Ohio, and Pennsylvania) had State hour laws for women workers limiting the daily hours to 8 in manufacturing; in 4 others (Missouri, Texas, Oklahoma, and Kansas) the limit was 9 hours, and in 1 (Tennessee) it was 10½. The statutory weekly hour regulations for women in manufacturing were 48 in California and New York, 44 in Pennsylvania, 45 in Ohio, 49½ in Kansas, 54 in Missouri, Oklahoma, and Texas, and 57 in Tennessee. The States with weekly limits of less than 48 hours had issued emergency permits to individual plants for longer hours when need of relaxation of hour standards for war production could be shown.

Of all the workers, men and women, 60 percent were on the day shift, 30 percent on the second or evening shift, and only 10 percent on the third shift, in the early months of 1942. All the plants had two or three shifts for men—18 had three shifts and 5 two shifts for men—with considerably more men on the first shift. In 10 plants all shop women were working on the first shift, in 11 plants women were employed on two shifts, and in 2 women were employed on all three shifts but with relatively few on the third shift. Most of the women were on the first shift.

Men's scheduled hours usually were the same as women's but there was greater irregularity in the hours of men and overtime in excess

of their daily and weekly schedule was reported as occurring frequently.

Lunch periods usually were 30 minutes for the first and the second shift, but men on the third shift often ate on duty or had a 15-minute rest period. In some of the plants women were allowed to leave their work places 5 minutes earlier than the men to avoid the rush and stampede out of the shop at quitting time.

## PERSONNEL REQUIREMENTS, POLICIES, AND PRACTICES

### Preemployment examinations.

In the aircraft industry as in other war production all employees are required to bring proof of their citizenship, to be finger printed, be cleared with the Federal Bureau of Investigation, and have their former employment and references checked. In all the large plants physical examinations are required.

In selecting women employees a number of firms were aided by giving mechanical aptitude tests, ring and pin-block types of tests, and other standardized tests. In some of the aircraft communities the United States Employment Service was administering aptitude tests for all employers requesting them, and had devised tests especially adapted for some of the more common woman-employing occupations. A number of California firms that had availed themselves of this testing service were most enthusiastic about women who had been referred to them as a result of this sifting process. Other firms were very definite in their opposition to such testing. Intelligence and personality tests were used by a few firms and one firm in particular felt that such tests had enabled them to select an especially desirable group of employees.

### Age.

Most of the plants reported a minimum hiring age of 18 years but usually made the qualifying statement that preference was given to women over 21 and often added that women from 25 to 40 years were preferred. Upper age limits were not definitely admitted, and women in their fifties or even sixties were pointed out, but actually the older and middle-aged women were a small group. Aircraft being a new industry has been one of young workers and the average age for both men and women has been under 30. The most usual average ages reported for women ranged from 26 to 28 years and for men the average was even less, which has resulted in serious inroads by the armed forces and has caused a revision of age standards and a stimulated interest in the employment of women.

### Marital status.

Prejudice against the employment of married women was rare in the aircraft assembly plants. A number of plants preferred women with dependents, on the ground that they were more stable in their job relations. When women were first inducted into the aircraft industry, a number of firms instituted special employment policies based on family relationships. Some stated that they would hire only the wives and daughters of men employees, hoping by this policy

to lessen housing congestion in their area and to alleviate transportation difficulties by having family groups transported to work together in a family car. Also, if postwar recessions require reduced personnel, it was planned that one or more of a family might be laid off without taking away all wage-earning support of the group.

On the other hand, some would not employ husbands and wives or near relatives in the same plant, and others would not employ them in the same department, fearing that shop discipline might be affected or confidential production secrets be more easily revealed outside the plant by members of family groups. Only one firm, however, reported definitely that they would not hire married women, and in that plant women who married while in the company's service were allowed to stay on. Wives of men in military service, and in California the widows of Pearl Harbor, often were given special consideration and employment priority.

In general, as more women are added to the working force and as the available supply of labor dwindles, less attention is given to policies of employment based on family status and most employment discriminations of this nature are fast disappearing.

Actual figures were not available on the marital status of women but estimates made in a number of plants indicated that slightly less than half (35 to 50 percent) were married, about 30 percent were single, and the remainder came from broken family groups—widowed, separated, or divorced women. One firm reported that about two-thirds of their women employees were responsible wholly or partially for the support of children.

### **Uniforms and work-clothing standards.**

War-production girls in natty uniforms with firm insignia have made good newspaper and magazine pictorials. Actually most of the firms were not requiring definitely stipulated types of work clothing for women any more than for men, and stated that they were opposed to such regimentation and were merely requiring that women be safely and suitably dressed for work. Such requirement usually recommended slacks and simply made shirts or blouses, with short uncuffed sleeves loose-fitting enough to be comfortable but not so loose as to catch in machinery. Low-heeled shoes with a closed hard toe were recommended for comfort and as a safety measure. Rings and jewelry around moving machinery are dangerous and were discouraged; a bracelet or ring caught in a machine may mean the loss of an arm. Heavy hair nets, bandannas, or caps often were required of all girls working on or near machinery, as stray curls caught in a whirling machine may mean a scalping as well as the loss of hair. Several of the companies had prepared printed suggestions and instructions for women's work clothing that were presented to each new female employee.

Several plants, in some cases at the request of the women themselves, had approved company uniforms for women, which were sold at the plant or at local stores. In a few instances the wearing of the company uniform was required, and when required there usually were repercussions on the part of some of the women, especially of women who had been employed in the fabric divisions before the present emergency and felt that there was little need or glamor in such regimentation.

Typical of the types and cost of required uniforms were the provisions of one large aircraft company that had arranged for a local merchant to sell three types of garments, the cheapest a blue-denim coverall sold at \$3.50, next a two-piece shirt and slack cotton-gabardine suit for \$5.50, and for those who desired a finer work suit, a shirt and slack suit of closely woven rayon and better workmanship at \$8.95. The last named was suitable only for the cleaner jobs, such as factory clerk and some of the inspection where the worker is not exposed to oil, grease, and dust, or cuts from sharp edged tools. Whether or not required, the women usually wore slacks, low-heeled shoes, and some protective hair covering.

Goggles or plastic eye shields were required for women on the same jobs on which they were required for men, and almost all the women who were welding or were grinding, polishing, or operating other machines from which particles of metal fly out were observing this precaution. Some of the firms furnished goggles and shields as company equipment.

### **Tool kits.**

Tool kits of workable hand tools as required for the job must be provided by the women as well as the men. Tools needed vary, of course, with the job. Drill-press operators, welders, spray painters, some of the inspectors and others do not furnish their own tools, but the majority of the workers do so and women must expect and be willing to furnish the same job equipment as men. The machine operators on machines such as lathes, hand screw machines, milling machines, and grinders usually furnish calipers, small micrometers, scales, steel rules, scribes, ball-peen hammers, trammels, a variety of wrenches, and so forth. Bench assemblers, final assemblers, and precision assemblers also must own such tools and usually in addition several types of pliers, center punches, and cutting snips.

### **Labor unions.**

Fourteen of the 23 plants in which women were production workers had union open-shop bargaining agreements with organizations affiliated with either the A. F. of L. or the C. I. O., 8 with the former and 6 with the latter. Of the 14, 13 had the same beginning rates for men and women, which were 60 cents an hour in 8 plants, 65 cents in 2, 55 cents in 2, and 30 cents in 1 small plant; the last named had an incentive system of payment, on a production-bonus basis, and 30 cents was the lowest guaranteed hourly rate, with higher actual earnings. One plant—an A. F. of L. plant—had a sex differential with the lowest or beginning hourly rate for men 55 cents, and that for women 50 cents. Of the other 9 plants, 7 had no collective bargaining for wages and 2 had agreements with independent unions. Beginning rates followed the same pattern as in plants with collective bargaining; 6 had entrance rates of 60 cents for both men and women, 1 had 50 cents for both, and the 2 remaining had a 10-cent sex differential, men starting at 60 cents and women at 50 cents.

Of the 3 plants with no women shop workers, 1 had an A. F. of L. agreement, 1 an agreement with an independent union, and 1 no agreement. The beginning wage was 50 cents an hour in the first and 60 cents in the other two. In the 13 plants with A. F. of L. and C. I. O.

affiliations having the same entrance rates for men and women, when the workers, regardless of sex, had completed the learning period they were to be paid the rate for the job.

In a number of the cities union representatives reported that though women were new in their organizations their numerical representation in proportion to the number employed was as great as that of men. Women in aircraft are serving on grievance committees, and at least one was representing her fellow employees as a delegate to the local central labor council. Unions accept the induction of women into the plants when the pay is based on the job and not on sex, as then they need have no fear of wage cutting by women.

## WORKING CONDITIONS

The aircraft plants are new, with good lighting, good ventilation, and new equipment, usually with the latest safety devices. Since most of the plants were built with no plan for women, toilet and dressing rooms in some cases are inconvenient and inadequate. Even some of the new buildings still in process of construction were giving little attention to special toilet and restroom facilities for women. Girls employed on jobs that can be performed while seated sometimes sit on boxes and makeshift chairs. Difficulties of getting chairs and equipment for rest and toilet rooms even with war-production priorities often were given as the reason for inadequate facilities. As more women are added, most of the plants are in need of additional and more convenient toilets and restrooms.

### Food service.

Provision of food during the lunch period is needed to safeguard the health, morale, and efficiency of workers. Many workers have no facilities for preparing lunch and are dependent on the food service provided by or near the plant. Most of the aircraft assembly plants had company provision for serving food during lunch periods or there were rows of private lunchrooms, hot-dog stands, and carts just outside the gates. Cafeterias and lunchrooms provided by the plant were in some cases so far removed from the shops and the lines were so long that with a 30-minute lunch period workers could not use these facilities. In a number of plants the use of lunch wagons—some of them practically rolling steam tables or ovens that could be plugged in at any electric socket—brought plate lunches, soup, sandwiches, desserts, hot and cold drinks into the factory. In one plant 3,500 employees were served in about 5 minutes by 17 lunch wagons. A choice of two lunches, one at 21 cents and one at 26 cents, provided an entree (meat or fish), vegetables, dessert, and milk or hot drink. Another plant reported that 24 new lunch wagons were more popular than the cafeteria. Lunch wagons that go through the plant and carry lunches often mean that workers have no respite from their workplace, and to alleviate fatigue and secure as much restoration of physical energy as possible during the lunch pause there should be adequate and convenient restrooms with chairs or couches where a few minutes' relaxation is possible for those who feel the need of it.

## AIRCRAFT SUBASSEMBLY AND PARTS PLANTS

In the United States as in England there is an increasing dispersal of the aircraft industry, the large aircraft assembly plants developing extensive subcontracting programs with firms normally engaged in all varieties of manufacture. Ten such firms, employing from 140 to 6,400 persons on aircraft subassemblies and integral parts of airplanes, were visited in California, Kansas, Missouri, Tennessee, Ohio, and Pennsylvania. These plants for the most part manufactured sheet-metal subassemblies such as wing sections, ailerons, flaps, elevator and rudder tabs, exhaust engine manifolds, cowling, shrouds, and air scoops. A few made oil tanks, gas tanks, pilot seats, firewalls, engine mounts, engine fittings, and bomber turrets. As the Women's Bureau continues its studies, more plants of this type will be visited. At this time it seems advisable to make a brief report on the employment of women in the 10 plants covered.

Two of the ten plants employed no women on productive operations, and in 7 of the remaining 8 the percent of women employed was less than 10, the average being 5 percent. The remaining plant slightly exceeded 10 percent. The 2 plants employing no women had no immediate plans for using them. Three plants knew a larger proportion of women would be employed but had no idea what the ultimate number might be because this was contingent on the duration of the war and the availability of male workers; the other 4 plants were in the process of hiring many more women and it was variously estimated that women might comprise from 30 percent to 70 percent of the employees when peak production was reached.

Five of the eight plants employing women had the same minimum beginning rate of pay for men and women, the rates being respectively 55, 56, 60, 65, and 69 cents an hour. In two plants there was a 5-cent differential in the beginning rates for men and women, and in 1 a 10-cent differential. Six of the eight plants were operated on a 48-hour-a-week basis. In two plants women worked on all three shifts, in four they were on two shifts, and in the remaining two on one shift.

Two firms were making stainless-steel manifolds. One employed over 100 women on acetylene gas welding and the other expected to have this many or more. In the plant first named all the women had gone through the company training school for welders, completing their training in from 3 to 6 weeks, and had passed the Army-Navy welding test and were certified class A, group 2, welders; for the other firm women had been trained in the local National Defense training school and were paid 51 cents an hour while in training. The Army inspector in one plant who had given women the welding tests found that they were more proficient than men on this lighter type of stainless-steel welding, and both firms planned to train many more women for welding because of their superior workmanship. Many of these women had no previous industrial experience and formerly were waitresses, teachers, and office workers.

There was the greatest prevalence of women on sheet-metal fabrication, bench work, and subassembly, all of which are interrelated and similar. They were filing and burring parts in the press and forming

departments, and forming and straightening parts with hand mallets, frequently accompanying this with the use of scales to check contour curves and angles. In connection with assembly of parts into small bench jigs and fixtures there was much hand and machine burring, use of electric and pneumatic hand drills, hand peening, use of arbor presses, and gun, squeezer, and machine riveting. All this work lends itself well to the employment of women and in most of the plants an ever increasing amount was to be done by women.

Women were assisting in the final assembly of wings, tail surfaces, and control surfaces into the larger floor jigs, fitting and clamping ribs, spars, beams, stringers, and so forth, fastening skin with Cleco clips, using electric and pneumatic hand drills, and riveting and bucking rivets.

In plants making fabric-covered control surfaces and wings women were performing the usual operations of power-machine work, hand and rib stitching, and stretching fabric over the framework. In some of the paint departments women were laying out parts on racks for spray painting and others were brush-painting primer coats on fabric surfaces.

In some of the machine shops women were being used on small and medium-sized drill presses and small hand screw machines. Women also operated punch presses and did spot welding. They were found commonly on both process inspection and receiving inspection, checking parts visually and manually with all types of gages, scales, and Rockwell hardness-testing machines, and checking parts against requisitions and blueprints. Other nonproductive operations on which women were employed were as blueprint-machine operators, blueprint file clerks, tool-crib attendants, production clerks, stock-room clerks, and as draftsmen and tracers.

These woman-employing occupations are precisely the same as found in similar departments of the airframe assembly plants and the proportion of women employed is closely parallel. There is an even greater opportunity for women's employment in the subassembly plants because the parts and plane sections are so much smaller, and because specialization in production has given rise to a breaking down of operations entailing much more repetitive work, which women can learn quickly and easily. The aircraft subcontracting program is just gaining momentum, and within the next 6 months to a year will come into prominence as a major field of employment for women in war industries.

