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Women's Employment in Foundries, 1943

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FOUNDRIES VISITED

During the second half of 1943, representatives of the Women's Bureau of the United States Department of Labor visited eastern and middlewestern foundries in connection with studies the Bureau was making of the utilization of women in the heavy metal-working industries. Some of the foundries were a part of good-sized machine-tool establishments, and some, though engaged primarily in foundry work, had small machine-tool production departments; the majority, however, did no machine-tool work other than that required for maintenance.

In the foundries visited most of the castings were being made of steel, but some foundries were also making cast-iron and malleable-iron castings. One, which specialized in making steel castings, also had a smaller foundry where brass castings were made, and here, the parts handled being smaller, more women were used than in its steel foundry. Another foundry made castings entirely of aluminum or zinc and differed from all the others in that it used the die-casting process.

This report will be confined to women's work in the foundry itself, excluding separate machine-tool divisions and the office, maintenance, and service departments. Plant statistics made it impossible to arrive at figures with exactness—for example, in some cases there were employees who did maintenance work as well as production—but inconsistencies probably are slight. Women in appreciable numbers were employed in the administrative offices and in plant clerical work, and a few were in maintenance and service, though as recently as 1 or 2 years ago the firms employed practically no women in any capacity.

While most of the foundries were job-production plants, they had war orders that called for a certain amount of production of a repetitive nature. A few of the foundries produced small as well as large castings. The wide range of products made by the companies visited included castings for the following: Locomotives, turrets for tanks and gun carriages, gun mounts, leveling sockets for guns, elevator parts for airplane carriers, armor for tanks, tank hulls and housings, hydraulic presses, rolling-mill machinery for steel mills, large parts for machine-tool builders, ships' parts, towing and hoisting equipment, various parts for trucks, tanks, and torpedo boats, turbo superchargers, valves and fittings, various smaller parts for machines, and ordnance and ammunition components.

EXTENT OF THE USE OF WOMEN AND FACTORS INFLUENCING SUCH USE

The foundries studied differed in size and in the type of work being done. The plants (excluding, as already explained, those sections not

directly connected with the foundries) ranged in total employment from 254 to 5,275 workers, and in number of women employed from 4 to 819. Of a total of 22,622 workers in the foundries covered, excluding all clerical workers, 3,631 of the workers, or 16 percent, were women. The percentage of women in these various foundries ranged from 1.6 percent to 43.4 percent. The foundry with the greatest total employment (5,275) employed only 10.8 percent women, and the one with the greatest percentage of women (43.4) had a total employment of only 495 persons.

Obviously, the proportion of women did not depend on size of foundry. Instead, it depended in varying degree on such factors as the shortage of male workers in the labor market; the size of the castings that were being made; and the extent to which the foundry was engaged in job or production work. Probably male-labor shortage was the chief determining factor, for while some of the plants visited that made very large castings required weight-lifting which, they believed, could not be eliminated, other plants broke down similar jobs to permit the use of more women where there was a great shortage of male labor. Foundries engaged largely in job work, sometimes making no more than one casting from a pattern, could not utilize "green workers" so easily as production foundries where some of the jobs could be broken down to utilize unskilled workers on mass production or repetitive work. Due to the labor market, some of the foundries were using women on jobs not really suitable for women, and others were not utilizing women to any degree though they could have employed them in many suitable jobs.

Some foundries mentioned the fact that they could use more "green help" (or women) if they were able to secure more skilled workers. Men have been avoiding foundry work and therefore in many foundries there are too few skilled workers available to keep production up to capacity. It is easier for foundries operating to capacity and using a large force of workers to utilize women, because these foundries can often subdivide jobs so that some of the weight-lifting and strain incidental to many of the jobs can be removed and so that some jobs or parts of jobs can be done by unskilled workers (dilution of skills).

It was not always true that the foundries with the most favorable working conditions and the most modern labor-saving equipment made the greatest use of women. The foundries visited presented great contrasts in working conditions or general environment.

DESCRIPTION OF FOUNDRY WORK AND WOMEN'S WORK IN FOUNDRIES

A foundry is that branch of the metal-working industry in which an object of metal is made by pouring molten metal into a mold of the desired shape. The metal solidifies and is called a casting. The casting, though given a preliminary cleaning and finishing in the foundry, usually is the rough piece of metal on which fashioning is done in machine shops.

If the casting made in the foundry is to have a hollow interior, a form in the desired shape of the hollow interior is made. This is called a core. The core is inserted in the mold so that the metal flowing into the mold flows around the core.

Cores and molds are made, generally speaking, of a mixture of sand, clay, and a fluid binder. Different formulas are followed, depending on the size and shape of the casting and the metal to be used. Less frequently loam is used in place of sand in the formula, and sometimes molds and cores are made of a cement mixture. The mold and the core can be used for only one casting, except in the uncommon and limited die-casting process where the mold is made of metal and can be used over and over again. (See p. 12.) In this study most of the description of the various departments of a foundry will be confined to the typical foundry where the sand core and the mold must be destroyed after each casting is made.

The pages following give an abbreviated and simplified account of the work done in the production departments of a foundry, together with a summary of the types of work that women now are doing in the various departments in the foundries visited by the Women's Bureau. At the end of this section of the report (page 14) there is a list, by department, of the occupations filled by women in the 13 foundries surveyed, together with a table showing the distribution of women in the several departments in 6 of the foundries that had the most complete statistics (page 13).

The Patternmaking Department.

The pattern is the wooden (sometimes metal) form into which sand (or other material) is pressed to shape the core, or the wooden pattern around which sand is pressed to shape the depression in the mold. The pattern is not destroyed, as the core and mold are, but can be used over and over again. Pattern making is exacting and highly skilled work. Patternmakers in wood are skilled woodworkers, having, in addition to that skill, an understanding of mathematics and blueprint reading and a knowledge of casting problems, such as where molten metal should enter the mold for a particular type of casting, how much to allow for the shrinkage of the metal after it is poured, and where to mark the pattern for vents. The maker of metal patterns must be a skilled machinist.

The patternmaking shop usually is separate from the foundry. There is also a pattern storage room where patterns are received, classified, stored, and issued.

Work for Women.—In the foundries surveyed patternmakers had trained unskilled women helpers to clean, sand, letter, shellac, or paint wooden patterns, to attach the little fillets that are pasted on patterns to round off sharp corners where parts are joined, and to check or measure patterns against blueprints. Women were also used occasionally as helpers to metal patternmakers. They very readily do pattern-storage work where small rather than large patterns are involved.

The Coremaking Department.

The core, around which molten metal flows at pouring time, forms the interior of a hollow casting. The core is made separately from the mold and is inserted in the depression in the mold that shapes the outside of the casting. In some foundries both core and mold are made of cement, but in the usual foundry both core and mold are made of a special type of sand. When sand has been firmly packed into the

wooden core-pattern the pattern is turned over on a board or steel plate and tapped lightly with a mallet. It is then removed from the sand core, which retains the shape of the pattern. This will be half of a core, since cores usually are made in halves, to be joined after the cores are baked in ovens. A number of small cores can be turned out on one plate. The plates are then lifted to racks and later moved into the bake ovens.

After baking, each core is inspected, patched where required, and painted or given one of several types of coating. The parts of the core are pasted together or assembled. Women are generally said to be especially good at making the small cores because of their finger dexterity, which usually is superior to that of men.

Some cores are so large that the pattern is in sections, with sides that are bolted together and that later, after the core has been turned over, are removed one by one to release the core. The coremaker tamps in large quantities of the specially prepared sand. He uses bent steel wires called gaggers, or heavier rods, depending on the size of the core, as reinforcing inserts in the sand. With a wire or wax tapers the coremaker makes special openings for vents in the core. After the core box has been turned over on a plate, the core box is removed and the huge plate containing the core is set aside ready for the oven. Sometimes more than one man has to do the lifting, and hoists and conveyors also are used. Skill as well as strength is required for the making of large cores. Coremaking machines of various kinds are used to some extent in foundries but these machines do only part of the work of coremaking.

Work for Women.—In the foundries visited, a few women were making cores of the larger sizes, but this was production rather than job work and required less skill. A few women were operating coremaking machines.

Women were used as helpers throughout the core shops. They were doing such jobs as tending the ovens, sandpapering or finishing the baked cores, measuring and inspecting them, patching them by filling in rough edges with a putty-like mixture that dries in air, painting them or coating them with a silica wash. They were pasting the two halves of the core together or joining, by pasting, additional core sections, since on some complicated cores there are projections that have to be made separately and joined to the main body of the core after baking. The work of women on these relatively unskilled jobs is limited in extent if cores are large and if the foundry provides no help in lifting.

The Molding or Moldmaking Department.

Preparing the Mold.

The mold is the body or mass of sand containing the patterned cavity that determines the external shape of the casting. Molds, like cores, generally are made in halves, and these are fitted together after the core is set in. Molds may be made of cement but usually are made of sand. There is a four-sided container, sometimes of wood, sometimes of steel, called a flask, into which the sand is packed. The flask for the top half of the mold is called the cope and the flask for the bottom half is called the drag. The pattern for the cavity to be made in the sand is placed in the flask, specially prepared fine facing

sand is packed around the pattern, and coarse backing sand is then piled into the remainder of the flask as a support so that the mold will not break apart when the molten metal strikes it.

The sand or cement in the molds is reinforced with wires and rods and sometimes wire grills or arbors. Sometimes pieces of metal, called "chills," are placed against the pattern when the facing sand is being packed around the pattern, to regulate the cooling of the molten metal when it strikes the sand for castings whose parts are of unequal thickness. When the flask has been turned over, the flask for the second half of the mold is prepared like the first. After completion this is lifted from the pattern and is turned over. The pattern is then removed from the first flask.

In the process of moldmaking, the moldmaker makes an opening in the sand for the entrance of the metal and connects this, by molding and cutting a runway in the sand, with the patterned cavity in the mold. This entrance and pathway for the molten metal is called a "gate." The moldmaker also punches holes in the sand of the mold for vents to allow the escape of gases at pouring time. There is an additional section to the patterned cavity called the "riser," into which some of the molten metal may rise, at time of pouring, to allow for a supply of metal as the casting contracts while cooling. All extraneous parts of the casting, like the gates, the risers, and the fins (rough edges where the two parts of the mold are joined), must be removed from the casting later in the cleaning or finishing department.

The moldmaker and his helpers inspect and clean the patterned cavity in the sand, patch any broken sections, and strengthen the curved edges, in some of the larger molds, by inserting steel nails. Sometimes the molder applies a wash to the cavity and dries the sand of the cavity either by torch or in an oven.

After the core, properly supported, has been set into one completed half of the mold, the other completed half of the mold is placed over it and the two halves of the flask are bolted together. Sometimes the flask is removed before pouring.

Many foundries have machines to assist with the making of molds. The squeeze machine, which makes smaller molds, and the jarring, or jolting, or jolt-roll-over machines for larger molds, come in different sizes and types. In principle, however, they pack the sand in the flask and remove the pattern, and the roll-over machines also turn over the heavy flasks. There is more or less heavy work for the moldmakers using these machines, however. For instance, there is some lifting and turning of flasks on the squeeze machines and on the jolt-roll-over machines some tamping of top backing sand with pneumatic rammers, not to mention the sifting of facing sand over the pattern from sieves, or the shoveling of backing sand, hand work that sometimes is required of the machine molder.

In floor molding for the very large molds, workers may use long, heavy, vibrating pneumatic rammers to pack in the sand tightly. Some foundries have a sand-slinger machine that runs on tracks and ejects sand into these large molds with such force that the sand is made firm and compact. The operator of the sand-slinger machine may be a woman, but the worker who stands beside the mold and

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pushes and pulls the heavy impelling head of the machine, from which the sand is forced into the mold, has work that is not only dirty but far too heavy for women. It is said that many of the men doing this work have acquired hernias.

Molds, when ready, are moved to the proper area for pouring. For the largest molds, pouring is done in the area on the floor, or in a pit, where the mold was made. Molds frequently are braced to prevent their breaking apart when the metal is poured. Very large molds may be braced with huge steel beams that are clamped to the tops, sides, and at the base of the mold.

There are five classes of molding:

(1) Bench molding, or the preparation of small and simple molds.
(2) Squeeze-machine molding. Some lifting is involved even on the smallest squeeze machines.
(3) Molding-machine or jar, jolt, roll-over, or jolt-roll-over machine molding for larger molds than those prepared by the squeeze machine.
(4) and (5) Floor molding for the largest molds. This includes side-floor molding and big (or main-) floor molding. Some of the largest castings are made in sunken pits.

Work for Women.—In some of the foundries surveyed, women were making bench molds. In others, they were acting mainly as helpers to the skilled moldmakers at machine molding, side-floor molding, main-floor molding, and pit molding. Some of the women helpers were little more than errand girls and laborers and some were doing rather skilled work, patching and helping with the fine finishing of the molds, or placing some of the small cores. In some of the foundries jobs were so broken down that the women, instead of doing a variety of work as helpers, specialized in such jobs as drying the mold cavities with gas torches, checking the size of the mold cavity, assembling arbors and straightening gaggers, and greasing "chills." A few women were operating the sand-slinger machine.

Preparing Sand for the Core and for the Mold.

In most cases exact formulas are followed for the preparation of the sand for coremaking and for the facing sand used in the molds. Different formulas may be followed for different jobs. Determining the formula and testing a sample of a prepared batch of sand-mix is a laboratory control job in many foundries. Sand is tested for permeability, moisture, compression, green strength (before baking), and dry strength (after baking).

The ingredients are mixed in the foundry in large quantities. Most foundries have large, electrically operated mixing machines called sand mullers or sand mills. Sometimes the loading of the machine—at least in part—is a laboring job.

Sand-conveyor systems, often enclosed to prevent dust, convey sand to the various parts of the core and mold departments, and the operator of the sand-conveyor system sees that hoppers are filled when necessary. The sand-conveyor operator often sits on a catwalk above the work section of the molding department.

In some foundries the sand is not prepared or tested so carefully as here outlined. The sand may be mixed with other materials right on the floor of the coremaking or molding department, either by hand for

small quantities or by sand-cutting machine for larger quantities. Sometimes machines are used for the drying of sand. When used molds have been broken up, the used sand is reclaimed. Used cement also is reclaimed, being ground up in enclosed machines.

Work for Women.—In a number of foundries women were operating the sand mills and the sand-conveyor system and in some cases they were doing the laboring connected with supplying the sand-mill machines.

Women were observed, in various foundries, operating the reclaim machines, the sand-drier system, shoveling and mixing sand, and doing other laboring jobs connected with the sand system.

Women were employed as sand testers (sometimes in the laboratory) in many foundries and were said to be especially good at this work.

Pouring Molten Metal Into the Molds.

Molten metal is brought from the furnace section of the foundry to the mold section and is poured into the molds. Pouring may be done off and on throughout the day or only at a stated and limited time. Molders may act also as pourers, but this practice is unusual. Pouring for small molds may be done from long-handled ladles carried by hand (this is heavy work), or from small ladles guided along a monorail support. Pouring for large molds is done from ladles carried by overhead crane. The metal pourer, with his helpers, not only guides the ladle into place over the gate of the mold but controls the stopper of the ladle when the ladle is bottom-poured, or the tipping of the ladle when the ladle is lip-poured. The pourer must not miss the gate of the mold, he must not allow the molten metal to overflow from the gate, he must know how much and how fast to pour. Skill and responsibility are involved in pouring. Not only is this a hot job but it has its hazards.

No women were used at metal pouring in any of the foundries surveyed.

Shaking Off the Molds, Knocking Out the Cores.

Small molds are broken up very soon after the metal is poured, and the casting is picked out of the broken-up sand. Cores inside the casting also are broken up and shaken out and the loose wire gaggers are removed. With small molds this is sometimes accomplished simply by throwing the warm molds into a pile on the floor, helpers fishing out the small, hot castings from the pile of sand with hooked picks. Frequently larger molds are battered by weights from a crane, or are placed on a grating where the sand is shaken loose by an electrically operated shake-out machine. Even with the shake-out machine much hand labor and lifting is required of laborers; the work is dirty; the castings are hot; and the machine is noisy and causes much vibration for the operator.

Cement molds on large castings are not easy to remove. They are first battered by weights carried by cranes, to break off some of the cement. Later, after the castings have been allowed to cool slowly for some time, the remainder of the adhering cement, with its many heavy-rod reinforcements, must be loosened by long, heavy, pneumatic chipping hammers. The cement cores with their reinforcing rods and bracings also must be removed, by long chipping hammers, from the inside of the castings. This is strenuous, dusty, noisy, and very difficult work.

Work for Women.—Only in one foundry were women doing any work connected with the removing of castings from the molds. There women were operating the shake-out machine, and the work was thought to be not entirely suitable because of the vibration.

The Furnace or Melt Department.

Metal for castings may be prepared and melted in electric furnaces, open-hearth furnaces, cupolas, reverberatory or air furnaces, tilting furnaces, and crucible furnaces, depending on the requirements of the foundry. The type of furnace used makes practically no difference in the work, so far as the possible utilization of women is concerned. A small crew of melters and melter helpers, or furnace tenders and furnace chargers, work at the furnace or furnaces. The work involves much skill and responsibility and sometimes strength; there is, in spells, much heat; and there are all the hazards of work with hot metal. When the furnace is tapped, the melters and their helpers take charge of the pouring from the furnace.

Furnaces and ladles have to be patched or completely relined at intervals with heat-resistant material. Ladle liners and their helpers tear out old linings, patch linings, lay bricks for new linings, and dry out the ladles or keep ladles hot with oil jets and air set on fire.

Work for Women.—In the foundries surveyed women were used in the melt department of only one foundry, acting as helpers for the furnace charger and giving most of their time to the weighing of scrap. One woman was operating a crane to supply stock to the melt department but she was not transporting molten metal.

The Metallurgical Laboratory.

Not only must a sample of the molten metal be tested by the melter at the furnace at intervals throughout the melting, but samples of every heat are sent to the metallurgical laboratory for physical and chemical testing. The work in the laboratory has been broken down so that much of the routine testing can be done by relatively unskilled workers under the direction of a skilled chemist or metallurgist. Various machines are used for making physical tests.

Work for Women.—In the foundries visited by the Women's Bureau, women were operating machines for physical tests, making routine chemical tests, making spectroscopic tests, acting as laboratory aides, charging castings to testing furnaces, and repairing instruments for the laboratory. There were a few women who were skilled chemists.

The Cleaning and Finishing Department.

Castings, when removed from the mold, are "in the rough." Sand that adheres to the surface of the casting must be removed by sandblasting, fins must be ground off, gates and risers must be cut or burned off, rough surfaces must be smoothed by grinding, and defects must be patched by welding.

Sandblasting.

Sandblasting of large castings is done in specially constructed, enclosed sandblast rooms, where the sandblaster operates a pneumatic hose to shoot steel shot, steel grit, or, less commonly today, sand particles at the rough castings. The worker has to exercise judgment in the amount of sandblasting that is done, and much lifting and

turning of castings is sometimes necessary. The occupation is a rough one and a hazardous one, with a danger of silicosis, though the worker today wears heavy protective clothing, a helmet over his head, and is supplied with compressed air for breathing.

Smaller castings are cleaned in an enclosed sandblast machine, in many cases a rotary machine. The worker feeds castings to the machine and removes them, often giving them a quick visual inspection at the time. Though these machines are enclosed and have exhaust connections, some of them permit sand dust to escape into the foundry when joints of the machine are not completely tight.

Work for Women.—In several of the foundries visited, women were doing this feeding and taking-off of work at the rotary sandblast machines when the parts to be lifted were not too heavy for a woman to handle.

Small castings may also be cleaned in revolving tumblers, and women were doing some of this work.

Chipping.

Cleaning of larger castings involves chipping with pneumatic chipping hammers or chisels, large and small. On very large castings, especially on the castings made in cement molds, there is much of this strenuous work. Chipping hammers, if large, cannot be managed by women. Though women can handle smaller chipping hammers, the work is generally considered unsuitable for women because of the vibration. Very small pneumatic chisels for bench work may not be harmful for women to use. Since chipping hammers frequently are used to clean large castings, weight-lifting may be necessary, unless the job has been so broken down that all turning of castings is done by laborers or hoists. Chipping hammers are very noisy. There is the constant danger of eye injuries from flying chips of metal. All workers in the cleaning department of a foundry should wear goggles.

Work for Women.—Women were working as chippers in the foundries visited. Those who operated the small pneumatic chisel grinders or bench chisels did not object to the work, but frequently some woman operator of the larger chipping tools would give up her job because she could not stand up under the work.

Grinding.

Grinding of castings, to give them a smoother finish, may be done with the large swing grinders; against stationary grinding wheels, large and small; or with portable grinding wheels or lightweight, portable pneumatic grinders of different shapes and sizes.

Work for Women.—The swing grinder consists of a large grinding wheel supported by a long arm and counterbalanced. The worker stands between two metal handlebars, which he manipulates as he pushes, pulls, and guides the wheel over the large casting. This work requires considerable strength. There is also great vibration, felt over the entire body. The work is not suitable for women. Women were operating swing grinders of smaller and larger size, in some of the foundries visited.

Stationary grinding or stand-grinding involves pressing and holding the casting against a revolving grinding wheel. If the castings are small this work can be done by women. Women were stand-

grinders, at both large and small grinding wheels, in several of the foundries surveyed.

The operation of portable grinding tools, if the tools or the parts handled are not too heavy, is entirely suitable for women, and women were doing this work in some of the foundries visited by the Women's Bureau. They were using the 3-inch to 5-inch portable grinding wheel and the small pneumatic "pencil grinders."

Burning.

Risers and gates usually are removed from the larger castings by burning, using the acetylene torch. The metal fumes from burning are a gastric irritant to some workers, though respirators can be worn. There is also the danger of small burns. The job, unless so broken down that weight-lifting is done by crane or laborers, often involves turning and lifting the heavy castings.

Work for Women.—A few women were employed in the foundries as burners. More women were merely burner helpers and did none of the burning or weight-lifting.

Welding.

Arc or acetylene welding is done to patch up defects in the casting and not to join parts. Where very large castings are involved the welder may have to work inside the casting as well as outside, and this is true also of burning. Welding may involve some lifting of heavy castings.

A few women were working as welders in the foundries.

Power-Operated Machines.

There are various machines, automatic in operation, in the cleaning department of the foundry. For instance, hydraulic straightening presses, large and small, are used to true up parts of castings. Feeding the machine may involve some lifting of heavy parts. Further, the operator cannot be unskilled, since judgment is required to know what should be done to the casting and where the pressure should be applied. In a job shop where the work is not repetitive "green" workers are not likely to be trained for this work.

Automatic machines (shears) to cut off sprues or gates may be used on small castings. Metal bandsaws or handsaws also may be used to saw off gates, and hand files may be used to remove burrs.

In some establishments, such as die-casting foundries (quite different from the usual foundry), there may be machine-tool work for finishing the castings, and many automatic machines, especially adapted for the cleaning and finishing of the castings, may be in operation.

In the foundries surveyed by the Women's Bureau some women were found doing the foregoing types of work.

Forging.

A few foundries do some forging. Women seen in one foundry were operating the drop hammer, under the direction of the blacksmith.

Heat-Treating or Annealing of Castings.

Many castings have to be heat-treated to relieve stresses or strains created during casting and cooling of the metal. Small castings may be fed by hand to a continuous belt that leads into an annealing fur-

nace, while larger castings may be stacked in the furnaces by hand or lifted in by crane, or may be placed on a car, electrically operated, and run into and out of furnaces on tracks. Tenders of the heat-treat furnaces must light and regulate burners, regulate flow of oil, air, and water, watch recording instruments for temperature, open and seal doors, time the heat-treat, and so forth. For short periods of time the worker is in contact with heat. Some castings have to be quenched in water, and some in oil, and sometimes this involves weight-lifting. The jobs in the annealing section may be broken down in various ways to utilize women workers.

Work for Women.—Several plants visited used women in the annealing section, as annealers, annealer helpers, gas operators, gas-furnace operators, and heat-treat-furnace operators. There were women who lighted burners, tended the controls of the furnaces, and read the dials; there were others who did only part of the work of operating the furnaces, some merely feeding parts to the furnaces, some tending doors, some acting as helpers to the male operators. All weight-lifting that might be too great for the women and all "quenching" of castings was done by male workers.

Inspecting and Testing.

Castings must be inspected and tested. Much of the work is visual inspection in the cleaning department, and in job shops where large castings are made some of the visual inspecting of large castings may require the exercise of considerable judgment and an understanding of foundry processes. There are also various tests of castings, such as the water test (a bench-work job) for small castings, magnaflux testing, the Rockwell hardness test, fluoroscopic tests, and X-ray tests.

Work for Women.—In foundries doing production work on small castings, many women were used at bench work for visual inspection, as "first inspectors," combining a quick hand-cleaning operation with visual inspection, as "floating inspectors," and as "final inspectors," sometimes combining the weighing and counting operations with the final inspection. In other foundries, some women were giving a visual inspection to larger castings, using a lamp or flashlight and marking defects in the casting. Women were also working at all the special tests mentioned above.

Painting.

Castings usually are painted, often spray painted, to protect them from rust before they leave the foundry. Women were doing some of this work in the foundries visited.

The Shipping Department.

Weighing, counting, packing, and checking of castings, in some cases done in the shipping department of the foundry, frequently are done by women if the castings are small. Women do some of this work where large castings are involved if jobs are broken down to prevent weight-lifting.

Occupations Common to All Departments.

The Operation of Lift Trucks and In-Plant Tractors.

Electric tractors or lift trucks cannot in all cases be operated by new workers, especially women, in a foundry. Floors are likely to present

difficulties, with broken sections, different levels, crowded aisles, dirt, and clutter. Not only is there much jouncing in a tractor, which may bother women, but it may be difficult for an operator to manipulate the vehicle safely if he is unfamiliar with the foundry. Women have proved excellent workers at driving lift trucks and tractors in many of the war industries, but the suitability of their work in this connection in foundries—though a few women were found doing this work—will depend largely on the environment of the particular foundry.

The Operation of Cranes.

Electrically operated overhead and side-wall cranes and magnet cranes are utilized for lifting in modern foundries. In crowded foundries where cranes pass directly over the heads of workers, the crane operator has tremendous responsibility not only for the valuable castings, the molds and the cores, but for the life of his fellow workers. Crane operators who carry ladles of hot metal must be highly skilled and dependable.

Work for Women.—In the foundries surveyed, no women were operating cranes that conveyed molten metal or were used to break up cement molds, but women were operating cranes in almost every other section of the foundry. Women make excellent crane operators, but it is easier and safer to use new workers, whether women or men, as crane operators where there is more space and where the work can be arranged in such an orderly fashion that cranes, with their heavy and dangerous loads, can pass over free aisles for much of their conveying rather than over the heads of helpless workers.

General Labor.

Much continuous and hard labor is necessary to the operation of a foundry, but only two of the foundries visited seemed negligent about guarding women against lifting more than a woman should handle. Many women were used in the separate departments or throughout the plant for either the light-labor jobs, such as the never-ending sweeping and clean-up work (some of the women at the constant "dry sweeping" in the dusty foundries wore respirators), the carrying of core plates, and the wheeling of core racks into the ovens, or for the heavier-labor jobs that involve such tasks as shoveling, filling, pushing, and dumping wheelbarrows, stacking bricks, and unloading boxcars and hopper cars. The unloading of hopper cars, with their slanting bottoms, is not always pleasant work for the laborer, who must maintain his footing inside the car while he shovels out material that sticks to the sides of the car.

DIE-CASTING FOUNDRY WORK

Die-casting foundry work, where the metal poured is often aluminum or zinc, is not typical of the usual foundry. In the die-casting process the metal is cast directly by machines in permanent steel dies rather than in sand molds. The dies are set in large casting machines. In oversimplifying the description of a die-casting foundry it can be said that the operator of the machine sets the die in the machine, pours in a small quantity of molten metal for each casting operation, pulls the long lever that activates the hydraulically operated machine, and

removes the completed casting. In such a plant the foundry proper consists, therefore, largely of rows of die-casting machines together with a furnace section or melt department. Castings made by this process—a process that is limited to certain types of work and cannot be adopted by most foundries—are relatively clean, and when they leave the machine are already made to tolerances that approximate fairly closely the size and shape required in the finished product. Therefore, much of the work done in inspection and in the cleaning and finishing departments is bench or machine work that more nearly corresponds to what is done in companies specializing in the final machining of castings rather than in the making and selling of the rough casting. At time of visit the one die-casting foundry surveyed was using no women in the melt or die-casting-machine departments and there were no jobs in those departments that were considered entirely suitable for women. Though the die-casting machine is power-operated, the operator must have considerable strength for the continuous work and he must know also how to handle emergencies when anything goes wrong with the machine. The machines in this one plant were crowded rather closely together and in some sections of the area there was heat, since the furnaces were nearby and small ladles of molten metal were being transferred throughout the shop at frequent intervals. More than 28 percent of the workers were women, but they were engaged almost entirely in the cleaning operations—which in this plant involved hand work or the use of automatic machines for the most part—and in inspection, testing, weighing, and packing.

Women's Distribution by Department in 6 of the Foundries Surveyed by Women's Bureau

Department	Foundry—					
	A	B	C	D	E	F
Women employed in foundry proper:						
Number	30	79	54	586	214	341
Percent	100.0	100.0	100.0	100.0	100.0	100.0
	Percent distribution of women by department					
Drafting (tracers, blueprint workers, etc.)	----	----	3.7	----	----	----
Pattern shop	----	----	7.4	0.3	----	----
Coremaking	50.0	10.1	16.7	3.6	35.0	14.7
Molding and sand system	16.7	16.5	5.5	17.9	3.7	21.1
Cleaning and inspecting	20.0	38.0	25.9	53.1	60.7	19.3
Melting furnace	----	----	----	----	----	1.2
Laboratory	----	1.3	13.0	2.6	----	1.8
Lift-truck operating	----	----	----	4.1	----	----
Crane operating	3.3	21.5	----	1.0	.5	11.7
General labor	10.0	12.7	27.8	17.4	----	30.2

List of Occupations Filled by Women in 13 Foundries

(Some of the occupations overlap, since jobs are broken down differently in the various shops)

Drafting or Engineering Department

Blueprint maker.
Blueprinter and blueprint filer.
Draftsman (skilled).
Tracer.

Pattern Shop

Laborer, pattern shop.
Metal-form (metal pattern) helper.
Metal-form labor.
Pattern sander and painter.
Pattern storage (receive, store, issue patterns).
Pattern-storage labor (shellac, sand, paint, letter, glue fillets).
Patternmaker checker (pattern checker, learner).

Coremaking Department

Bench coremaker.
Core assembler, core joiner, or core jointer.
Core cleaner.
Core finisher.
Core gager.
Core glazer.
Core inspector.
Core painter.
Core paster.
Core-plate handler.
Core-shop labor.
Core stacker.
Core-storage worker.
Coremaker (maker of large cores).
Coremaker (maker of small cores).
Coremaker helper.
Gate coremaker.
Laborer.
Lift-truck operator, core room.
Oven tender.
Transfer-table operator.
Turnover-machine operator (coremaking machine).

Molding Department

Assembler of arbors.
Bench moldmaker.
Chill greaser.
Crane operator.
Lift-truck operator.
Mold checker.
Mold drier.
Mold finisher.
Mold-machine helper.
Molder helper.
Sand-slinger operator.
Shake-out-machine operator.

Sand System

Batchman.
Dumper.
Laboratory helper (sand tester who also acted as pyrometer helper for melt department).
Laborer.
Reclaim labor.
Reclaim operator.
Sand-buggy operator.
Sand-conveyor operator. Conveyor girl.
Sand-drier operator.
Sand-mill laborer.
Sand-mill operator.
Sand mixer.
Sand tester.

Melt or Furnace Department

Charger helper.
Crane operator—stocker.
Weighman.

Heat-Treat Department

Annealer helper.
Annealer operator.
Annealer-overman.
Annealing-furnace helper.
Furnace checker.
Furnace-door-tender operator.
Gas-furnace operator.
Gas operator.
Heat-treat-furnace operator.

Metallurgical Laboratory

Analytical chemist.
Assistant chemist.
Casting charger.
Chemical laboratory laborer.
Instrument repair.
Laboratory aide.
Laboratory helper, physical testing.
Machine operator.
Physical tester.
Routine chemist.
Spectroscopist.

Cleaning and Finishing Department

Arc welder.
Automatic-machine feeder.
Band-saw operator.
Burner.
Burner helper.
Casting painter.
Casting spray-painter.
Chipper.
Chisel grinder.
Crane operator.
Dark-room attendant.
Dimensional checker.
Drill-press operator.
Final inspector.
First inspector.
Floating inspector.
Fluoroscope operator.
Forming-press operator.
Foundry Gantry-crane operator.
Grinder.
Inspector.
Kick-press operator.
Laborer.
Lathe operator.
Light hand filer.
Magnaflux-machine operator.
Packer, light.
Portable-grinder operator.
Punch-press operator.
Rockwell hardness-testing machine operator.
Rotary-sandblast-machine operator.
Sandblast helper (helper to sandblast operator).
Stand-grinder operator.
Straightening-press operator.
Supervisor of inspectors.
Supervisor of weighers.
Swing-grinder operator.
Tapping-machine operator.
Tractor operator.
Tumbler operator.
Water tester.
Weigher.
X-ray developer.
X-ray operator.

Forge

Drop-hammer operator.

General (for several departments of foundry)

Clean-up labor.
Crane operator.
Crane operator learner.
Elevator (freight) operator.
Hooker (crane follower).
Labor.
Lift-truck operator.
Tractor operator.

Maintenance

Construction labor.
Guards.
Storeroom labor.

Maintenance—Machine Shop

Crane operator.
Heat-treat of chisels.
Laborer.
Lift-truck operator.
Machine operator (drill press, radial drill press, milling machine, grinder, lathe, gear cutter, and power saw).
Machinist helper.
Millwright helper.
Oiler.
Tool cleaner.
Tool grinder.
Toolroom attendant.
Welder.

Maintenance—Electrical Department

Armature winder.
Crane operator.
Electrician.
Electrician helper.
Oiler.

MAINTENANCE—SERVICE FACILITIES

Bus girl.
Canteen clerk.
Cashier.
Cook.
Counter girl.
Dishwasher.
Janitress.
Locker-room attendant.
Matron.
Nurse.
Porter.

PLANT—CLERICAL

Checker.
Expediter.
Factory clerk.
Foundry-schedule-room clerk.
Production clerk.
Schedule clerk.
Stock-record clerk.
Storeroom clerk.
Timekeeper.
Valve chaser.

GENERAL OFFICE

Bookkeeper.
Clerk.
Interviewer.
Machine operator.
Messenger.
Receptionist.
Secretary.
Stenographer.
Superintendent of women (women's counselor).
Switchboard operator.
Typist.

THE FOUNDRY ENVIRONMENT

Though not all foundries have modern equipment, all the 13 surveyed in this study had, to a greater or less extent, modern conveying equipment and modern labor-saving machinery. A few of the foundries also had new, large buildings with the best of dust-arresting, ventilating, and vacuum-cleaning systems and much space for the arrangement of their work. Some of the foundries, with their war orders, were crowding too much work into a space that originally was planned for a normally smaller production, and some had attempted to add modern equipment to a building that was too small. Crowding seems to be one of the outstanding problems in the foundry environment. Older foundries are likely to be too small in area because, in the days before modern conveying equipment was available, it was necessary to have all the work processes close together, especially to prevent cooling of the molten metal before it was poured. A few of the foundries visited were especially interesting in this connection because there were both new foundries and old foundries in the same plant.

Noise.

There is excessive noise in most busy foundries. This is especially true of the cleaning and finishing department, with its pneumatic chipping, its sandblasting, and its various methods of grinding. Electric furnaces—if such are used—are objectionably noisy. The molding machines, the pneumatic rammers, and the shake-out machine, which breaks up the molds and cores from the newly made castings, cause an intermittent racket in the molding department.

Floor Hazards.

As a rule, though there are great contrasts among foundries in this respect, walking about in a foundry has its hazards. Floors in some cases are uneven and broken; there is great clutter everywhere, no matter how constant the cleaning; sand accumulates on the floor of

the molding department; and castings of all shapes and sizes, in various stages of the cleaning process, are scattered about the floor of the cleaning section. Other castings, partially removed from cement molds if such are used, may lie about in the molding or pouring section, with projecting and warped reinforcing rods sticking dangerously from the broken cement. In crowded foundries even the aisles are not always kept open.

Dust and Fumes.

The air of a foundry is heavy with sand dust, especially if the foundry is making very large castings or is crowded into an old building of inadequate size. Foundries built in recent years usually have modern dust-removing, ventilating, and vacuum-cleaning systems, and many of the newer buildings are spacious, with exceptionally high ceilings. However, even these improvements cannot keep a foundry entirely free of dust while work is going on, because of the nature of the work. Though today much of the sand may be carried in a covered conveyor and rotary sandblast machines are supposed to be airtight, busy foundries sometimes allow equipment to get out of order and more sand escapes than should be the case. The sand used in foundries contains silica. There is also some metallic dust in the air, especially in the cleaning department. Hence there is, for all foundry workers, some likelihood of eventually contracting siderosis from the metallic dust or silicosis from the sand dust. At pouring time the air of the foundry is oppressively heavy with the smoky smell that rises when molten metal strikes the sand in the mold. Metallic fumes are a gastric irritant to some of the workers who are near the burning operations in the cleaning department.

Eye Hazards.

Where electric arc welding is being done in the cleaning section, not all foundries are careful about shielding the work so that nearby workers may be protected from the arc. Flying chips of metal are a special hazard in the cleaning department, and workers do not always wear goggles when they should. Radiant heat is injurious to the eyes of workers whose occupations keep them in contact with molten metal.

Hazards of Molten Metal.

At the furnaces there are all the hazards, together with the heat, that are connected with the preparation and melting of metal. In the pouring section there is the danger of molten metal slopping over from the hand ladles as the workers rush back and forth at their work. There are the hazards of molds exploding when the metal is poured, or of the spatter or "running over" of molten metal if the pouring from the large ladles is not carefully done. Cables to which are attached the large ladles of molten metal, carried overhead by crane—sometimes over the heads of many workers on the floor—have been known to break.

Overhead Hazards.

Overhead cranes with their heavy loads pass constantly back and forth throughout all sections of the shop—cranes carrying heavy steel flasks containing molds, cranes carrying huge castings, cranes carrying molten metal, magnet cranes carrying scrap. In foundries that are new and large, where the work can be arranged in more orderly

fashion than in old plants, it is often possible for cranes to transport much of their heavy burden over free aisles rather than directly over the heads of busy workers.

Work in foundries may be dirty, heavy, and dangerous, but it is interesting. In spite of the notable exceptions in certain occupations, workers in the heavy metal-working industries often appear less harassed and worn than workers in lighter but speeded-up work at line production. Foundry employees often have breaks in their labor, an opportunity to pause, look around, and talk with one another, and a variety of things to do in their work that relieves monotony. If the environment of the foundry is not too bad, if there is a good safety program, if the worker is assigned to a job that is suitable to limited strength and endurance, there is no reason why women, as new "green" workers, cannot fill a limited number of the less skilled jobs in the foundry, and no reason why some women—since women vary in their preferences as men do—might not find these jobs more interesting than the usual "woman's job" in certain factories.

WAGES, HOURS, AND WORKING CONDITIONS

Wages.

Minimum starting rates for women production or plant workers in foundries were concentrated at 70 to 71½ cents. In 9 of the 13 plants, with three-fourths of the women workers, the beginning minimum for women fell in this small group. In all but 2 of these, men's beginning minimum was the same as women's; in the 2 exceptions it was several cents higher than women's. In the large foundry that had more women than any other 1 plant the beginning rate was 78 cents for both sexes. At the other extreme were 3 small plants, with few women, that started women at only 45, 55½, and 60½ cents, respectively. Here the corresponding figures for men were 50 , 65½, and 71½ cents. Thus 8 of the foundries paid men and women equal starting rates, while in 5 there was a sex differential of from 5 to 11 cents an hour in favor of the men.

In about half of the foundries there was a provision for an automatic wage increase over the starting or minimum rate—a specific amount after a definite time interval. Sometimes this was accomplished in one step, sometimes in two steps. The amount of the increase varied from a total of 5 cents an hour to a total of 10 cents an hour, in each case after 3 months.

In 11 of the plants surveyed there were, for all workers except those in the unskilled jobs or in the "labor pool," definite job rates, sometimes with a range of rates on each job allowing for increases by merit and seniority. In at least 11 plants some of the women had been advanced to specific jobs and were receiving job rates rather than the unclassified labor rate. In one of the foundries paying equal starting rates, women placed on jobs with job rates were kept in the learner classification for 30 days longer than men. In the foundries that paid women a lower starting rate than men it was also true that when the women had been placed on a specific job carrying a job rate (above the starting rate), frequently such rate was lower for women than for men on the same job. It was claimed by management that some of the jobs had been broken down in order that women might be able to

do them, and that in the instances where rates were different for men and women, the women were not doing the whole job as it had been done by men.

The wage rate was figured on an hourly basis in all the plants. For a number of the jobs in each of 8 plants there were either additional incentive rates or departmental production bonuses divided among the workers.

The prevailing rate paid to women production workers at time of study ranged from 65 cents to $1 an hour.[1] However, since some firms included the incentive earnings in this estimate and some did not, comparisons cannot be made. In at least 4 plants the prevailing rate was still the starting rate. In 8 plants the apparent increase in the prevailing rate as compared to the starting rate ranged from 3½ cents an hour to 22 cents an hour. It is likely that incentive earnings were included in the estimates for the higher prevailing rates, but this cannot be determined from the data available.

In 9 plants a higher rate was paid to workers on the second and third shifts, in some cases slightly greater on the third than on the second shift. This shift differential varied from 2½ to 6½ cents an hour in one system of figuring, and from 5 percent to 10 percent over the worker's base rate in another system. A third method of providing for a shift differential was to pay the workers on the second and third shifts for a full 8-hour day though they worked but 7¼ hours.

Hours.

It is difficult to summarize weekly hours of work with accuracy, since sometimes there are departmental variations within the plant. Also, hours within a department may fluctuate, due to shortage of workers or to rush orders or a cut in orders. Very occasionally second and third shifts are somewhat shorter than the day shift, to provide time for lunch and a reward for the workers on the less desirable shifts. In States whose laws require that women be allowed a definite lunch period, women in some cases (see p. 20) are paid for a shorter day than the men, though the over-all hours of work may be the same.

In the foundries visited by the Women's Bureau the most usual pattern (day shift) was a 48-hour week of six 8-hour days. In 1 plant the men were working only a 5-day, 40-hour week, and in 4 plants the men were working more than 48 hours, some working (by department) 50, some 55 or 56, some 60, and a few 72 hours a week. Women's hours, considering the time taken off for the lunch period, fell into the following groups: 40 hours a week, 5 days (1 plant); 45 hours, 5½ or 6 days (2 plants); 47½ hours, 5½ days (1 plant); 48 hours, 6 days (7 plants); 45 or 48 hours, 6 days (1 plant); and 50 hours, 5 or 5½ days (1 plant). Thus the most usual hours were 48, on six 8-hour days.

All but 3 plants were working 3 shifts, and 2 of the exceptions were working 2 shifts. In 5 of the plants women worked on only 1 shift; in other cases they worked on all 3. There was an arrangement for weekly rotation of shifts in only 4 foundries. In the others, with occasional departmental exceptions not affecting the women, shifts remained fixed. One company stated that it made special effort to

[1] Ascertained not from an examination of pay rolls but from an estimate made by management, and hence only approximate.

help working housewives and mothers by arranging suitable hourly shifts for individual women, but another reported that most of the women were obliged to work on the second or third shifts because the union protected the seniority rights of the regular male workers and most of the men preferred the first shift.

Though men were required occasionally to work more than the scheduled hours—sometimes a 7-day week or sometimes through more than one shift in continuous operations—it was reported that at date of survey there was little overtime for men or women. Some plants did not permit women to work beyond the number of hours scheduled, and in no instance was a woman required to work more than 50 hours a week.

Because there is very little that approximates line production in the metal-working industry, formal arrangements for rest periods are not common, nor perhaps always necessary. However, the environment of a foundry is not pleasant and the work is often exhausting, and consequently a formal rest period—especially to break the long morning—is considered by some foundries as contributing to better work. A formal rest period of from 5 to 15 minutes in the middle of both morning and afternoon was allowed for men in 2 plants and for women in 3 plants. In 3 other foundries there was a formal rest period of 10 minutes for both men and women in the morning. In several foundries with no formal rest periods, provision nevertheless was made for definite intervals of time off the job for metal workers, crane operators, and a few others, depending on the nature of the work.

In plants having 3 shifts of an 8-hour turn it is not possible to permit a lunch period without extending hours so that shifts overlap, and an overlapping of shifts is almost never feasible. Therefore, even on jobs that do not require it, the custom is for workers to eat on the job or at their work. At this time they usually are allowed a little less than 30 minutes' leisure, more frequently 15 minutes, on company time. In foundries, as in steel mills, workers often have "spells" of waiting on different processes, or breaks in their work, and so, if they bring their lunches or buy refreshments at the canteen or from the snack truck that goes through the plant, they have plenty of time for eating and frequently are found lunching at odd hours of the day. However, this arrangement does not permit a worker to go to a cafeteria for a hot lunch and proper relaxation.

Many State laws provide that a female employee must have a definite lunch period of at least a half hour. Because of this there were 2 foundries among those visited by the Women's Bureau that paid women for a 7½-hour turn though the men, who probably had as much time in which to eat, were paid for an 8-hour turn. The men's lunch period was not indicated definitely and they may not have been so free as the women to leave the job for a full half hour.

In 2 foundries with the 3-shift arrangement, both men and women on the first shift had a definite half-hour lunch period, not on company time. This was due to the fact that second- and third-shift workers, whose half-hour lunch period was on company time, worked less than 8 hours (though paid for 8 as an incentive to work on the less-desirable shifts). In 2 of the 3-shift foundries women were employed in departments that worked only on the day shift, since not all departments in 3-shift plants worked the 3 shifts, and so it was possible for the women, and some of the men, to have a 1-hour

lunch period. In 3 of the 3-shift plants, and in some departments of a fourth, women, like men, had a lunch period (less than a half hour) on company time. In the 3 foundries that, with some departmental exceptions, operated only 1 or 2 shifts, the women and most of the men had a 30-minute, 55-minute, or 1¼-hour lunch period.

Food Services and Facilities.

Four of the 13 foundries surveyed maintained 1 or more cafeterias that served hot meals and food of considerable variety, and 1 other plant was adequately cared for by a restaurant across the street from and controlled by the plant. Another 2 of the foundries had commissaries, without seats or tables, where the workers could buy sandwiches, hot and cold drinks and desserts. Another had a similar commissary where hot plate-lunches could be bought. In the 5 foundries where there was neither cafeteria nor commissary, milk and cold drinks were available in 2, and in another sandwiches, coffee, and other light refreshments could be bought at a concessioner's lunch wagons that passed through the plant.

Six of the foundries that had no cafeteria where workers could sit down to eat provided at least tables and chairs for this purpose either in the women's rest rooms or in special "lunch-eating" rooms, and in 1 of these rest rooms coffee and tea were made ready for the women by the matrons at lunch time.

In 2 of the foundries there was a special food service for those who ate on the job and could not get to the cafeterias and for those who wanted refreshment during the day. "Snack trucks" with light lunches went through the plant not only at noon but also in the middle of the morning and the afternoon. This kind of service is appreciated in large plants where all workers are not equally close to the cafeterias and cannot get to them conveniently in the short lunch periods. Two of the foundries surveyed attempted to meet this problem by having cafeterias in more than one building of the plant.

It is interesting to note that only 1 foundry was completely indifferent to supplying any place to eat or any food for the workers. In the other foundries, though great differences in the food services were apparent, there seemed to be a growing interest in providing adequate food and a place in which to eat.

Medical Facilities.

Because foundry work is heavy and hazardous, all the foundries surveyed required a preemployment physical examination, 9 of them including X-ray of the lungs for men and 8 including X-ray of the lungs for women. Only 3 plants definitely required a Wassermann and 2 required a blood test. Considerable emphasis was placed on examination for hernia, blood pressure, and heart condition. One plant specified that it did not require so rigid an examination for women as for men, and one that its examination was more rigid for women than for men. Because of the tight labor market in this war period, probably no company has been so careful in the selection of workers, on the basis of a physical examination, as it was in the past.

All but 1 of the foundries had some kind of hospital or dispensary at the plant, but there were great differences in the facilities provided; some were units of several rooms, with small bed wards and all kinds of equipment for examination and treatment, and others were simple

dispensaries, a few being crowded, untidy, and ill-equipped. All these 12 services had registered nurses on duty, usually throughout all shifts. Occasionally a medical student, a practical nurse, or a first-aid man served in place of the registered nurse on the third or smallest shift. In the case of all dispensaries there was at least 1 doctor on call at all times, and in 7 of them physicians were on duty at regular hours for part of the day.

Reexaminations of workers in the more hazardous occupations were, with few exceptions, not required. A few companies required that sandblasters be reexamined at regular intervals.

The one foundry that had no dispensary took care of minor injuries in the personnel department and had neither nurse nor doctor on duty. The personnel workers and some other employees throughout the plant were trained in first-aid work. This plant sent workers for examination, and treatment when required, to an industrial clinic several miles from the plant.

The plants surveyed reported that the new women workers, though "green" and not used to the environment of the foundry, proved to be safe and careful workers on the whole. Of course, the women workers were not employed on the more hazardous jobs, but like all workers in a foundry they were subject to the dangers and to the unfavorable environment of the plant. Slight burns and cuts, an occasional toe fracture or small foot injury from falling objects, a smashed finger, foreign objects in the eyes, were the most frequent of the accidents that had been reported for women. The one serious accident reported was the falling of a woman from a crane while she was learning to operate it. A few women operating lift trucks had been injured when their trucks backed into objects in the crowded foundries, and several women operating lift trucks complained of the constant jouncing caused by operating trucks on the uneven floors.

Some women seemed to be doing work that was too heavy for women and some were subject to harmful vibration. This was especially true of the women operating swing grinders and chipping hammers. One plant reported that the turn-over rate among women chippers was very high. The harmful effect, if any, of these occupations that are considered unsuitable for women cannot be determined at this early date. Constant standing; heat, on some of the jobs; the danger from objects falling from overhead cranes; the dust-laden air; the fumes, the dirt, and the noise were objected to by some of the women.

Work-Clothing Requirements and Practices.

There is not much danger of women insisting on wearing impractical or glamorous clothing in a foundry, and the observance of the simple factory rules in regard to clothing seemed to be better in foundries than in some other plants. Some of the foundries reported that they secured the willing cooperation of the women by making the rules advisory rather than mandatory, and one company, which was very strict in enforcing its rules, allowed the women to take part in the making of the rules when first they were drawn up.

In only two of the plants were there no requirements, mandatory or advisory, about clothing. In one of these plants the women sometimes wore house dresses rather than slacks and some of the women wore open-toed shoes. In all the other foundries women wore serviceable coveralls or slacks or men's overalls, and though, unfortunately, few

wore safety shoes, most of them wore heavy and sensible shoes. The majority of the women kept their hair covered to protect it from the dust, usually wearing bandannas.

Women frequently wore canvas gloves at their jobs, and where the job required it some wore protective equipment, such as respirators and goggles. Compliance with plant rules in regard to the wearing of goggles, where required by the job as is true of so much of the work in a foundry, was complete in some plants and half-hearted in others. Some companies required that all workers wear goggles throughout the whole foundry. Special protective clothing was required for the men working around the furnaces and at the pouring.

Six of the plants sold safety shoes and five sold slack suits, coveralls, or overalls, at the plant. Two companies supplied the women with their first uniform free of charge.

Toilet Facilities for Women.

Toilet facilities for women were adequate in all the foundries. There were great differences in rest rooms insofar as appearance and an atmosphere of cheer were concerned. Some of the toilet-rest-room units were purely functional and had no equipment that might encourage resting. In other plants management had made an effort to supply comforts and to create a pleasant environment for the women's leisure time. There was special reason for the latter arrangement in plants where the lunch period was sufficiently long for the women to enjoy the services provided.

Washing facilities were adequate and kept in good condition in practically all cases. Paper towels and soap generally were supplied, and where there were no dispensers of women's sanitary supplies these usually could be bought from the matron, stationed in the toilet rooms of some foundries. Ten of the foundries had provided showers and 10 had provided full-size individual lockers. Two companies supplied small purse lockers and clothing was hung below them on hangers. One plant, without space or equipment for lockers, met the problem by having a checking system in charge of the matron in the toilet room.

Many of the toilet-rest-room units comprised more than one large room, and frequently the cot or cots were in a separate room. Nine of the foundries supplied at least one cot, some of them several cots. A number had couches also, and fairly comfortable chairs for lounging. Nine of them provided extra space, in some cases large, in some small, with tables and chairs, for eating lunches in the rest rooms. In two cases there was an electric stove where tea and coffee, soup, and so forth could be prepared or heated.

Many of the larger plants had, in addition to the main toilet-rest-room unit, separate toilets and washing facilities in various sections of the shop.

Drinking facilities usually were adequate and sanitary throughout the plant.

Absenteeism and Turn-over.

The method of keeping absence and turn-over statistics differed so among the plants as to make comparison of findings hardly practicable. While four plants found women's absentee rates noticeably higher than men's, four others claimed that women's rates were lower than men's, and in still four others women's and men's rates seemed to be very nearly alike.

In two companies that had machine-tool plants and that kept absence statistics broken down by foundry, machine-tool plant, and office, the absence rate both for men and for women was much higher in the foundry than in other parts of the plant. The following are some of the causes of absenteeism mentioned by management: Sickness, tension and fag from long hours of work, necessity to care for personal and family problems, the nature of the occupation and the unpleasant environment of the foundry, and the poorer quality of some of the workers now employed. Lack of adjustment to the work, among new workers, together with the fact that the natural process of selection has not had time to cull out from among them the ill-adapted, means of course that the absent rate, as well as the turn-over rate, usually will be higher among newer employees than among the regular workers who have been employed by the plant for some time.

The companies surveyed had not, as a rule, any particular complaint about women's turn-over rate being too high; in some plants their rate seemed lower and in some plants higher than the men's rate. In speaking of turn-over in general, management seemed to feel that a high turn-over rate was to be expected in foundries, because the work is laborious and the environment unpleasant and hazardous. Foundry management's chief worry was the difficulty of securing workers while jobs in other industries were plentiful, this difficulty being aggravated by the fact that the wage level in foundries is not high, considering the nature of the work. Though management was inclined to believe that most men left their jobs because they were unstable or because they wished to "better themselves," it was likely to attribute other reasons to the women who quit, such as, "the work proved too heavy," "the glamor of war work had worn off in the grime of the foundry," or "there were personal and family problems." Wives of service men, leaving their jobs in foundries as in other industries to join their husbands, frequently have a high absence and turn-over rate. In one foundry bad personnel practices were thought to be the cause of a high turn-over among all employees.

A few foundries gave some attention to a good exit interview with all workers desirous of leaving the company, and some of the personnel directors thought this had real value in aiding management to detect weaknesses in the supervisory staff and to discover other problems, but few personnel workers thought the exit interview was of any noticeable value in cutting down turn-over.

Every community today has housing and transportation problems, but these problems were not so great in the areas where the 13 foundries were situated as to be considered important causes of absenteeism or turn-over. Only 4 of the foundries visited reported a housing shortage in the area, and none of them, with the possible exception of one that was trying to encourage a public housing project, was supplying any definite services to workers in finding housing. All but one of the companies tried to assist in simplifying the transportation problem, through the services of a special clerk, the personnel director, or a transportation committee, by taking care of gas and tire rationing and arranging for car-pooling schedules.

Though all the companies employed women with children and though home duties were admittedly a cause for some of the absenteeism and turn-over on the part of women, no company felt that there

was enough definite evidence of need of community nurseries and after-school care to work on this problem itself. Some personnel directors were becoming interested in the subject of child care, on the supposition that public child-care facilities might become necessary if the war were to continue much longer. For the present, however, most companies felt either that there were sufficient facilities available in the locality for those whose home problem could be met by such services, or that there was still a sufficient supply of women available to make it unnecessary to employ mothers who had no relatives at home to care for their small children. Since these foundries were using local rather than inmigrant women, there was likely to be a relative or neighborhood friend of the woman worker who would help in the care of the children. Sometimes the best worked-out plans went awry, however, and the woman had to return to her home. All the foundries agreed that there was not yet such a shortage of female workers that the company must employ women who were needed in their homes more than in the war industries.

PERSONNEL POLICIES IN HIRING, TRAINING, AND ADVISING WOMEN

Because it has been especially difficult to secure the male workers needed in foundries, and because foundry work not only does not attract many women but in general is heavy work, it is not surprising that the foundries visited by the Women's Bureau placed few restrictions on the hiring of workers. There were no intelligence or aptitude tests and, except for the skilled jobs that women were not prepared to fill, requirements in regard to education, previous experience, or vocational training were limited to laboratory and plant clerical workers, where a high-school education sometimes was required. Of course this relaxation of hiring rules is not uncommon in other industries today. The emphasis in selection, in the foundries, was on stability and good health and strength. The preemployment physical examination and, usually, a good first interview in the employment office were considered important. There was some attempt to fit the woman to the job. Agility and dexterity might be required on some jobs and physical strength and endurance on others.

For these reasons none of the foundries visited had any hard and fast rule in regard to the maximum age of the women employed. Four of the plants felt that the work was too strenuous for most women over 50. However, women of 50 were not uncommon and there were a few over 60 who were doing a good job at very hard work. Eighteen was the minimum age for women in 10 of the foundries, and 20, 20, and 21 were the minimums in the 3 others. Nine foundries preferred women over 30 (up to 35, 40, 45, and 50) and only 1 reported a preference for women under 30. The foundries that stated definitely that they preferred the mature woman worker gave as their reasons the fact that the older women had proved, by and large, to be more stable, less unsettled by the "urge for glamor," more conscientious and harder workers. A few stated that though the older woman might be better on the harder jobs, the younger woman was necessary on the jobs that required agility or constant standing. There seemed to be no general policy in regard to age. All the firms agreed that the problem was less a matter of age than one of personal fitness.

Some of the women employed were housewives who had had no experience at work outside the home or had been away from such work for a long time, others were women used to hard work in the home or on the farm (from the semirural areas), and still others had been working in nonessential industries. Many were wives of service men. Most of the women came from the local community or the surrounding territory and were recruited from among the relatives or friends of workers already employed by the company.

At time of visit, since standards had been lowered, only one of the foundries excluded women who had small children. However, in all the plants it was usual for the employment office to ask women applicants if they had provided adequate care for the children and to refuse to hire women who had been unable to make arrangements for such care. There is apparent a slight tendency in personnel and employment departments toward a relaxation of this rule, because of the difficulty in securing women workers. This was indicated by personnel workers who said that it did little good to worry about the woman's home obligations when she was applying for employment, because even under the best of arrangements emergencies could arise when she would have to give up her work in favor of her duties in the home.

Most of the foundries stated that the foundry was "no place for the pregnant woman." A few of the plants had a general pregnancy policy for all their female employees, permitting employment for a few months and a return to work after confinement provided the worker secured a doctor's certificate, but it is not clear, since women are new in the foundries and not all the women in the plants work in the foundry proper, that this policy would apply to women working in the foundry itself.

Eight of the foundries employed Negro as well as white women.

All training for new, "green" workers who are to be used during the war emergency was on-the-job training in the foundries visited. Some had used vocational-training schools and vestibule classes for training their first new workers, but all the emphasis at time of survey was on training on the job. To improve supervision, at least seven of the foundries had taken advantage of the Training-Within-Industry courses of the War Manpower Commission, but in only one of the foundries were there any women in these classes (a few women "key workers").

Very little was done by the foundries in the way of special orientation of new workers. Only one had an "induction class" (of 3 hours) in which plant policies were explained to new employees. In two plants the women's counselor talked at some length about plant rules, jobs, and so forth, to each woman worker as she was inducted. In two foundries this introduction to the plant was cared for in varying degrees of thoroughness by the industrial nurse, in one by the safety engineer, in one by the employment interviewer, and in one by the personnel director. However, all plants agreed that the foreman to whom the worker reported had most of the responsibility for orienting the woman to the job and to the plant.

Five of the foundries employed a woman to act in the capacity of women's counselor, though she was not called by that title.[2] Though the major emphasis in their work differed in the various

[2] One of the five women was lost recently to the "armed services."

plants, all five of these "counselors" were assigned the task of listening to and advising the women who had personal grievances or family problems that they wished to discuss in the office. While there is need of women counselors in every shop where women are employed for the first time, to assist the foremen and fellow workmen as well as new women workers in adjusting to unusual conditions, such women advisers can aggravate the problem if they lose themselves too completely in the role of sympathetic listener and unconsciously encourage the women to bring too many of their personal and family problems to the plant for consideration. Nevertheless, male personnel directors who have the time to do good personnel work often state that they do much to improve plant morale when they listen to and advise male workers who bring a variety of problems to them. It is advisable for women's counselors to confine their activities to subjects of plant concern and to refer workers with family or other problems to the proper social-service agencies in the community.

Four of the women's counselors employed had a sound understanding of the jobs in the foundry and the work women could do there, and though they could not interfere with the foremen in the matter of women's work they were, in at least two instances, supposed to advise on the suitability of various foundry jobs for women.

Two of the counselors, who gave a great deal of time to the first employment interview and to the orientation of the new women workers, were in the employment department and were able by this means to learn a good deal about the women and to become acquainted with them. This interviewing of applicants can be a handicap to a women's counselor if the employment office is swamped with applicants, but it is a good introduction to counseling work if there is time for other duties.

These five women's counselors sometimes had something to do with exit interviews or absentee visiting. Sometimes the counselors were in charge of the upkeep of the women's rest and toilet rooms, and frequently they were required to enforce rules regarding women's work clothing and behavior in general. In these five plants, as elsewhere, the counselor had a job that was rather indefinite in outline. Everywhere the job grows and takes form only as management, the foremen, and the workers become accustomed to making use of the women's counselor, and provided that she herself has the tact, the understanding, and the ability to "make something of the job." [3]

In plants that had no woman definitely assigned to the work of women's counselor there was in many cases a nurse in the dispensary, or a matron in charge of the toilet and rest rooms, or a woman interviewer in the employment department to whom it was customary to bring personal problems that could not be handled by the male personnel director.

EMPLOYEE ORGANIZATION AND AFFILIATION

In three of the foundries surveyed there was no labor organization, and in a fourth, which was in the process of being organized against the strenuous opposition of management, there was a company union

[3] See in Women's Bureau Special Bulletin 16, The Woman Counselor in War Industries—An Effective System, 1944.

that was relatively inactive. In eight foundries the CIO represented the workers, though in three of these a few craftsmen, such as the machinists and the patternmakers, were members of the AFL. In one foundry the AFL represented all the workers. Women were reported as interested members of the unions, but of course they were too new in the industry and too greatly in a minority to exert much influence. Two of the small craft unions did not admit women, but this was of no particular importance during the war emergency since there were no women with the skills necessary for admission to the craft. Two of the large plant locals showed some discrimination against women in the matter of seniority and wage rates.

SUMMARY

There are skilled or semiskilled jobs in a foundry—for example, burning and welding—that do not require many months of training; there are other jobs, such as molding, that require a long period of apprenticeship. In many foundries a skilled worker, to be valuable, must have a knowledge of casting problems in addition to the skills of his craft. He must be able to exercise a degree of independent judgment on each job assigned to him. This is, of course, true chiefly of job foundries where almost every casting order presents a special problem, or of smaller foundries where the individual workman may be required to have a knowledge of more than one type of work. A large proportion of the jobs in foundries, even of the skilled jobs, involve physical exertion—heavy lifting, hard labor. Some of the jobs are hazardous. The general environment of the foundry, affecting all workers, is not only relatively unpleasant but more or less dangerous, partly because of the accident hazard and partly because of the danger of silicosis, siderosis, and other ailments, due to the air being laden with silica and metallic dust.

It is apparent that women, even if they wished to remain in foundry work after the war, would have little or no opportunity to acquire the higher skills or advance up the job-progression ladder. The heavy nature of much of the work would in itself preclude that, even for women as capable as men of learning the skills. The foundry is likely to remain a man's world.

Where foundries are so organized that jobs can be broken down to prevent heavy lifting and where skills can be diluted, there are many jobs that women can fill during the war emergency. A few of the foundries visited by the Women's Bureau indicated that they might even wish to keep women after the war in some of these jobs. Other individual foundries mentioned special jobs in which their women excelled, such as clerical work, drafting, laboratory work, sand testing, operation of the heat-treat furnaces, and the making of small cores, and stated that women might be retained on these jobs. Many foundries agreed that women were better than men at the making of small cores. Whether, with the limited opportunities open to them and with the unpleasant environment of the foundry as a deterrent, women will care to remain in such jobs after the war is a question that cannot be answered at this time. It seems improbable that many foundries will be interested in retaining these small groups of women, even in jobs in which they excel, in an industry that is predominantly male.

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