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# CHANGE HOUSES IN THE LAKE SUPERIOR REGION

BY

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## CONTENTS.

	Page.
Introduction.....	1
Scope of survey.....	1
Conditions in Lake Superior region.....	1
History.....	1
Types of change houses.....	2
Runways and tunnels.....	3
Waiting rooms.....	3
Sanitary surroundings for change houses.....	3
Sewage disposal.....	4
Arrangement of change houses.....	4
Floors and walls.....	5
Ventilation.....	5
Natural lighting.....	7
Artificial lighting.....	7
Heating.....	8
Shower baths.....	8
Wash troughs.....	10
Laundry tubs.....	11
Drinking fountains.....	12
Latrines.....	12
Urinals.....	14
Lockers.....	14
Drying racks.....	16
Benches.....	17
First-aid rooms.....	17
Rooms for mine foreman and shift boss.....	17
Carbide storage.....	18
Caretakers.....	18
Sanitation.....	19
Recommendations for the Lake Superior region.....	20
Construction.....	20
Runways and tunnels.....	20
Environs.....	21
Sewage disposal.....	21
Arrangement of interior.....	21
Floors and walls.....	21
Ventilation.....	21
Lighting.....	22
Entrances.....	22
Heating.....	22
Bath equipment.....	22
Wash troughs.....	22
Laundry tubs.....	23
Drinking fountains.....	23
Latrines.....	23
Urinals.....	23

Recommendations for the Lake Superior region—Continued.		Page.
Lockers.....		24
Drying racks and chains.....		24
Benches.....		24
First-aid rooms.....		24
Rooms for mine foreman and shift boss.....		24
Carbide storage.....		25
Caretakers.....		25
Sanitation.....		25
A modern change house.....		25
Rooms for foreman and shift boss.....		26
Change room.....		26
Washing equipment.....		26
Latrine room.....		26
First-aid room.....		27

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## ILLUSTRATIONS.

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	Page.
PLATE I. <i>A</i> , Well-lighted asbestos change-house; <i>B</i> , Showers in open stalls, fitted with mixing chambers for hot and cold water; <i>C</i> , Mixing valve and dial to give desired temperature of water.....	10
II. <i>A</i> , Cheaply constructed wash trough; <i>B</i> , Semicircular trough with basins in position; <i>C</i> , Double trough of white enameled iron, fitted with faucets.....	11
III. <i>A</i> , Semicircular wash trough with basins in drying position; <i>B</i> , Square wash trough of metal, showing floor drainage trough.....	10
IV. <i>A</i> , Double trough of white enameled iron, equipped with basins; <i>B</i> , White enameled sinks equipped with sprays.....	11
V. <i>A</i> , Drinking fountain of pedestal type; <i>B</i> , Drinking fountain of wall type; <i>C</i> , Fountain fixture with ring over orifice.....	14
VI. <i>A</i> , Individual type of latrine; <i>B</i> , Serpentine open-front seat for latrine	15
VII. <i>A</i> , Trough-type urinal of heavy enameled iron; <i>B</i> , Metal stalls for latrines.....	14
VIII. <i>A</i> , Double-compartment lockers; <i>B</i> , Drying rack of iron.....	15
IX. <i>A</i> , End of drying rack; <i>B</i> , Drying rack in use.....	16
X. <i>A</i> , Iron-pipe rails for lower ends of chains; <i>B</i> , A brick change house with a rubberoid roof and sanitary surroundings.....	17
XI. <i>A</i> , A change house of corrugated iron; <i>B</i> , A change house of brick with corrugated iron roof.....	16
XII. Details of a model change house.....	20
FIGURE 1. Dryhouse at Virginia, Minn., Mesabi Range.....	27
2. Change house on Vermillion Range.....	27
3. Dryhouse at Ely, Minn., Vermillion Range.....	28
4. Change house for 400 men, Virginia, Minn., Mesabi Range.....	28
5. Dryhouse at Hibbing, Minn., Mesabi Range.....	28
6. Dryhouse at Kewateen, Minn., Mesabi Range.....	29
7. Wash room at Bessemer, Mich., Gogebic Range.....	29
8. Locker room at Bessemer, Mich., Gogebic Range.....	30
9. Dryhouse at Bessemer, Mich., Gogebic Range.....	30

# CHANGE HOUSES IN THE LAKE SUPERIOR REGION.

By **CLEVE E. KINDALL.**

## INTRODUCTION.

Good health and strong morale among the employees of any industry are to-day recognized as important factors in the maintenance of a high standard of production. In the mining industry, sanitary change and wash houses increase the efficiency of the miners by enabling them to attend properly to their physical needs after strenuous exercise, often in damp or wet mines.

The body may be compared to an internal-combustion engine, which must be maintained at a fixed temperature to work at maximum efficiency. Its radiator—the body surface or skin—must be kept in good condition and free from the wastes that accumulate while it works, for no mechanism operates well when clogged with dirt. The body is provided with three other channels through which wastes may pass—the kidneys, bowels, and lungs. To maintain good health, frequent and regular elimination of wastes is indispensable; if the functioning of one or more of the organs of elimination is impaired, disease, lowered vitality, lessened efficiency, and impairment of mental and physical activities may result. Adequate and sanitary washing, bathing, and latrine facilities aid the functioning of these organs.

### SCOPE OF SURVEY.

This paper, with a few exceptions, presents data acquired in a survey, made by the author, of change houses in the Lake Superior region. All buildings, equipment, and practices were studied with regard for the health and welfare of the miner. The plans and description of a model change house embody the best features found in the change houses of this district, and the improvements the author wishes to suggest after his study of the problem. Many suggestions given herein may be applied to a change house in any locality, though they were formulated with reference to the particular needs of the Lake Superior region.

### CONDITIONS IN THE LAKE SUPERIOR REGION.

#### HISTORY.

When the mining industry was yet in its infancy, the miners changed their clothes at home, leaving the mines after work—dirty, tired, and often in clothes saturated with body excretions, a custom incon-

venient and resulting in much ill-health. Many miners found it more satisfactory to change their clothes in the boiler rooms. As the industry grew, the mining companies realized that change houses must be provided. These were mere shacks at first, but the modern change house was developed from these unpretentious beginnings. Even now some of the old inconvenient buildings are still in use.

A modern change house at a progressive mine has washing, bathing, and latrine facilities; here employees may change their clothes before and after work. Adequate bathing facilities are especially important at a mine whose ores are soft. Efficient drying equipment should be supplied if there is considerable moisture. Mine foremen and shift bosses at many mines in the Lake Superior region have offices in change houses. One of these offices may be utilized by the timekeeper when checking the men on the various shifts. The posting of safety-first notices and first-aid bulletins on the walls, a common practice in many change houses, is to be commended; in this way they add to many other functions that of agencies for spreading valuable information among the men.

#### TYPES OF CHANGE HOUSES.

The number of change houses in the Lake Superior region has increased steadily. Approximately 100 companies were operating about 500 copper and iron mines at the time this report was written. The investigator examined about 25 per cent of the change houses at these mines, and found many old houses still in use. Since mine operators have discovered that health and efficiency go hand in hand, however, the buildings and equipment have been improved noticeably. This improvement is most marked in the change houses built within the last five years.

A majority of the change houses investigated were of the most modern type, built of brick, stone, or concrete, and roofed with tile or rubberoid. The old buildings were made of wood or corrugated iron. The wooden buildings had roofs of wooden shingles, tar paper, or corrugated iron; and the corrugated iron buildings had roofs of the same material. A structure of concrete blocks or brick, roofed with tile, is recommended. If a material other than tile is used for roofing, it must be noncombustible.

The two tables following give the wall and roof material of the change houses inspected:

#### *Wall construction of change houses.*

Material.	Per cent of total inspected.	Material.	Per cent of total inspected.
Brick, stone, or concrete.....	38	Wood.....	15
Corrugated iron.....	42	Tar paper.....	5

*Roof construction.*

Material.	Per cent of total inspected.	Material.	Per cent of total inspected.
Corrugated iron.....	42	Rubberoid.....	14
Tar paper.....	17	Tile.....	12
Shingle (wood).....	15		

Accessibility to the shaft is an important feature to be considered in the placing of a change house. A few of the change houses noted were built as far as three-fourths mile from the shaft, a condition that is dangerous to the health of employees. Men who have been laboring hard underground in a hot, damp atmosphere are very susceptible to colds and pneumonia if exposed to a sudden drop in temperature. This is especially true in the Lake Superior region, where climatic conditions are extreme.

**RUNWAYS AND TUNNELS.**

At 6 per cent of the mines inspected, the possibility of exposure was eliminated by underground passages or tunnels from the shaft to the change house. These tunnels were built of cement, were well heated, and were lighted by electricity. They ranged in length from 150 to 300 feet, and averaged 10 feet in width and height. Only one had fire doors, a precaution essential to safeguard property and human life. If a fire should occur in a mine or a change house, it would be impossible to keep poisonous gases and smoke from traveling through the tunnel; and attempts to prevent the spread of the fire itself might prove futile without fire doors at the tunnel entrances.

Covered runways, heated, and of fireproof material, are used in other districts to connect mines with change houses. They are not recommended as highly as underground tunnels, for mines where economy of surface space is important. When used, they should be amply supplied with windows, electrically lighted, and comfortably heated.

**WAITING ROOMS.**

Some mines have, near the collar of the shaft, a small waiting room provided with benches where miners can sit while waiting to go underground. These rooms are heated in winter and cooled in summer, a convenience that adds much to the comfort of the men and can be supplied at small expense. Only one of these rooms was found at the properties in the Lake Superior region visited in this survey.

**SANITARY SURROUNDINGS FOR CHANGE HOUSES.**

Most of the buildings were in sanitary surroundings. A few had well-kept lawns beautified by flowers and shrubbery. This practice is to be highly commended, as it not only aids sanitation, but no

doubt interests the miners in keeping the buildings and surroundings in good condition. Sanitary conditions around a few change houses were far from satisfactory. Refuse was swept out of the back doors; loose papers, discarded clothing, tin cans, waste from carbide lamps, and the remains of lunches were thrown about the premises. Such conditions always draw disease-carrying animals and offer breeding places for disease-producing germs. The following table shows the conditions of surroundings at the change houses visited.

*Surroundings at Lake Superior change houses.*

Condition.	Per cent of total inspected.
Good sanitary surroundings.....	71
Fair sanitary surroundings.....	22
Poor sanitary surroundings.....	7

#### SEWAGE DISPOSAL.

Wastes of human origin and other sewage should be removed promptly and completely. Of the buildings visited, 55 per cent disposed of these wastes through sewers that emptied into near-by streams. This practice is condemned wherever the stream serves as a source of water supply farther down its course. Thirty-five per cent of the change houses used cesspools for sewage disposal. Cesspools should be built and used with regard to the surrounding soil. If the soil permits and there is enough space, the cesspool may be so constructed as to allow the fluid portion of the sewage to drain away at once. Such a cesspool may operate for a long time without being cleaned out if there are no wells near enough to be polluted. When the soil does not allow the fluid portion to drain off, the cesspool should be impervious. Under those conditions frequent cleaning is necessary. Eight per cent of the buildings inspected were so situated that they were able to use a city sewer system. Septic tanks disposed of the sewage from 2 per cent of the change houses. The treatment of sewage in septic tanks by bacterial action has become fairly common practice within the last few years, and is recommended as a hygienic method of caring for human wastes if the tanks are constructed and placed in accordance with approved specifications.

#### ARRANGEMENT OF CHANGE HOUSES.

Most of the change and bath houses investigated were of good size, roomy, and well equipped. Overcrowded conditions were evident in but few Lake Superior change houses. Some had separate rooms for lockers, showers, wash troughs, and latrines; others had only one large room.

To be utilized to its greatest capacity, a change house must be arranged conveniently. The equipment should be concentrated



and placed in the order in which it is used; orderly arrangement eliminates waste of time in taking unnecessary steps and avoids the congestion caused by men moving in different directions. A man should be able to enter the door of a change house from the tunnel and use the various kinds of equipment successively as he progresses toward the exit door on the opposite side of the building. (Pl. XII, p. 20, suggests a logical plan.) Such arrangement helps to discourage loitering or aimless walking about. Men who are most in need of washing or bathing facilities may be discouraged from using them if kept waiting. The change house then loses a big chance to establish regular habits of cleanliness and health.

#### FLOORS AND WALLS.

Ninety-two per cent of the change houses had cement floors; the remainder were of wood. All such buildings should have cement floors, as wood is kept clean with difficulty, and decays quickly when wet as much of the time as change-house floors are likely to be. Most of the cement floors were in good condition, but a few had cracked when the buildings settled. Such floors should be repaired, as dirt settles in them and there is some danger of the men injuring their bare feet on the rough edges. All floors were well drained and sloped either to the center or from the center to the sides, according to the position of the drainage traps. Drainage traps should be at the center of the room, so that the water will drain from the corners which will thus be dry and free from dirt.

The inside walls of 60 per cent of the buildings were brick, usually painted or whitewashed. Walls look neater when painted, as white-wash flakes off. Other change houses had walls of plaster, corrugated iron, wood, and asbestos. Plaster walls frequently crack and peel, on account of the dampness in change houses, hence they are not durable. Walls of corrugated iron and asbestos are rather difficult to clean, because dust and dirt stick to them readily. Wooden walls are not recommended, as they increase fire hazard. Brick walls painted a dark color for 5 feet from the ground, and above that to the ceiling of a lighter color, are superior to walls of other materials. The brick is fireproof, and the paint furnishes a smooth surface from which dirt and dust are easily removed. The dark paint on the lower part of the wall looks neater than light paint, which is quickly spotted. It is advisable to use light paint above the dark paint in order to give the rooms more light and make them more attractive.

#### VENTILATION.

A change house must be well ventilated, because it is particularly subject to odors and impure air and the dangers attendant upon such conditions. Men go directly to a change house after hard physical

exertion; they are not only covered with dirt and water from the mine, but their clothes are saturated with perspiration and other impurities eliminated by their bodies during work. These conditions contaminate the air and are aggravated by odors from the wash and latrine rooms. In order to counteract possible bad effects, ventilation must be good. Change houses should be equipped with numerous windows which can be opened to allow fresh air and plenty of sunlight. These are nature's excellent deodorants and disinfectants.

In a change house at a mine outside of this region the problem of deodorizing damp working clothes has been solved by a method which also dries them. The clothes are kept in steel lockers with upper and lower compartments, instead of being hung on drying racks or chains. The upper compartment holds working clothes and damp garments; the lower, street clothes. A steam pipe runs along the upper part of the lower compartment at the back and a vent is placed in the lower half of the door. There is also a quadrant-shaped vent, connected to a galvanized suction pipe, at the top of the locker. This pipe covers a corner in each of four lockers and passes up to a larger pipe in a system connected with an exhaust fan, which is in continuous operation and discharges outside. Fresh air from the room is drawn through the vent of the lower compartment, passes slowly over the hot pipe (thus having its capacity for moisture increased), and then goes through the upper compartment to the fan.

In buildings equipped with drying racks instead of lockers for working clothes, sheet-iron hoods over the racks are recommended to carry off the odors. A pipe should run from each hood into a common pipe that terminates at a fan which vents to the outside. The hot air rising from the steam pipes below the drying racks will carry with it odors from the clothes, and pass from the hood into its pipe and on out through the common pipe.

A change house should be thoroughly air-flushed several times daily; at such times the windows, doors, and roof-ventilating monitors should be left wide open for a period of five minutes. It would be well to do this during the cleaning that should follow each use of a change house by a shift. This natural method of ventilation splendidly aids any other in use, if the caretaker can be relied upon to do it with regularity and thoroughness. The responsibility necessarily rests with him, and at many mines this part of his work was found to be shamefully neglected. No artificial ventilating systems were in use in the change houses visited.

Two general types of roof-ventilating monitors have been noted in such buildings—those of wood, which usually run the full length of the roof, and those of corrugated iron, which occupy only a section of the roof. Monitors can be pulled open or shut by a rope that hangs from them. Roof ventilators are in disfavor with some operators because

considerable heat is lost through them, but they are essential where no artificial system of ventilation is in operation.

The windows in the change houses varied considerably in shape, size, and construction. Half windows about 7 feet from the floor were common in the latrine rooms and in locker rooms in which the lockers were placed against the walls. These were satisfactory when so built that they could be opened wide, but in a few houses this was impossible. All change-house windows should be so placed and constructed that they can be easily opened at any time to give the maximum inflow of air. Steel-framed windows with heavy opaque glass, 5 feet square, placed 4 feet from the floor, and with only a small center section that could be opened, were found in a few buildings. Such windows are not recommended because they do not furnish enough light and can not be opened wide during air-flushing periods. Fortunately, the majority of change houses had windows that could be opened at any time. (See Pl. I, A, p. 8, and note the shape, size, and position of windows.) Those above reach were opened either with a window pole or by using a stepladder. Windows about 30 inches square, 7 feet from the floor, with hinged bottoms, and with a chain at the top to limit the opening are recommended as most satisfactory for change houses. When the sash is inclined inward a space is left at the top through which air enters and is directed upward toward the ceiling where it is distributed to all parts of the room and slowly falls to displace contaminated air. A metal ring or hook into which the window pole will fit easily should be attached to the top of the window to facilitate opening. The outside entrance doors should be of good size to facilitate air flushing and to allow the quick and easy passage of large numbers of men—a matter of great importance in a fire. A revolving door is perhaps the most satisfactory outside entrance, as it does away with the possibility of the door being left open, thus causing direct drafts. Plate XII (p. 20) shows a revolving door. Nearly all change houses had storm inclosures at the entrances.

#### NATURAL LIGHTING.

The lighting was satisfactory in the majority of buildings. Windows serve a double purpose by admitting fresh air and light, hence it is a great mistake to fail to provide a sufficient number, so placed and constructed that they may be opened easily at any time. Plate XII (p. 20) shows the size, number, and position of windows in a modern change house.

#### ARTIFICIAL LIGHTING.

Ample light is particularly necessary during a change of shifts to expedite washing, bathing, and dressing. Electricity at 120 to 250 volts—mostly alternating current—was used for artificial

lighting in all of the change houses visited. The conduit system was installed in about 50 per cent of these buildings. The majority of buildings are well lighted and use drop lights with bulbs of 20 to 60 candlepower attached to cords 10 to 12 feet from the floor and spaced about 10 feet apart. Ceiling lights were used in a few change houses, but these failed to give sufficient light and are far inferior to drop lights. Switches that control either lighting system are usually placed near the main entrance.

#### HEATING.

Heating is another important factor in the functioning of a change house. The temperature should be kept between 75° and 80° to dry working clothes properly and to be comfortable for bathing. Of the buildings visited, exhaust steam was used for heating in 35 per cent, live steam in 49 per cent, and hot water in 16 per cent. All were sufficiently heated.

Mines electrically equipped and without boiler plants had furnaces in their change houses. Buildings without basements had furnaces in the change room; but this condition should not exist, as the dust and dirt from the coal and ash make it impossible to keep the room and equipment clean, and the smoke and the coal gases are detrimental to the health of the men. A basement should be provided to hold the furnace when one must be placed in the building; if this is not done, a separate furnace room is a necessity.

Radiators are used in the passageways, offices, and latrine rooms of most change houses. In the locker and wash rooms, on account of the lack of wall space, pipes are substituted for radiators. In such rooms, rows of pipes, two to nine in a row, are run along the walls about 1 foot from the floor. In the locker and wash rooms of some buildings these pipes are run overhead about 8 feet from the floor. Rows of two to eight pipes are also run underneath and on the ends of the lockers, inside of drying racks, between the rows of chains in the chain room; and, in some buildings, along the sides of the wash trough, just above the floor. All exposed pipes should be covered with metal screening or asbestos to prevent men being burned.

#### SHOWER BATHS.

Bathing is the greatest aid to the body in eliminating wastes through the skin, which assumes extra burdens during, and immediately following, strenuous physical work. The shower bath serves best in this capacity, because the force with which the water strikes the body stimulates the skin to act and throw out accumulated wastes. Moreover, the shower has been adopted most extensively because of its adaptability to use by large numbers. Only five buildings visited had tubs as well as showers.

Approximately 15 per cent of the men were taking advantage of the bathing facilities. This low percentage is probably due to lack of cleanly habits and to the inadequacy of the showers. The average number of showers in the change houses inspected was about one for every 25 men on a shift. Six change houses had no showers. This condition should be remedied to provide one for every 10 men on a shift. An abundance of hot water is also necessary. The change houses of the Lake Superior district were amply supplied.

The construction of showers strongly influences the extent of their use. All but 8 per cent of the showers in the buildings visited were inclosed in stalls of sheet metal, slate, iron, or wood. The doors or canvas curtains at the entrances of the stalls were frequently in disuse. Plate I, *B*, shows showers in open stalls. The stalls themselves are in disfavor among some of the miners, and in a few houses have been removed at their request. A greater number of men can thus use the showers in a given time, and the showers themselves can be kept in a more sanitary condition. Soap and dirt are splashed on the walls of inclosed showers during bathing, and it takes much time and patience for the caretaker to clean them. There is also some possible danger of injury to the bather, through slipping and hitting the walls.

All showers were equipped with hot and cold water faucets, and all but 5 per cent had mixing chambers. The efficiency of a shower is much increased by mixing valves. Each valve has an indicator dial on which "Hot," "Warm," and "Cold" are marked (see Pl. I, *C*) and water of the desired temperature may be had by moving the handle on the dial. Much time is saved thereby, a greater number of men can be accommodated by the same number of showers, much water is saved, and scalding is avoided.

The floors in most of the shower compartments are of cement, with drainage either at the center or at the back. In addition to the drainage trap in the floor of each individual shower, there is usually a large trap at the center of the shower room. Cement is recommended as the best material for floors, as it is easily cleaned and kept sanitary, and is very durable. The drainage trap should be placed at either the front or back of the shower. For sanitary reasons and durability, the walls near the showers should be surfaced with cement up to about 7 feet. Some change houses observed had separate rooms for their showers, while others used parts of the change rooms for that purpose; a separate shower room seems to be more satisfactory.

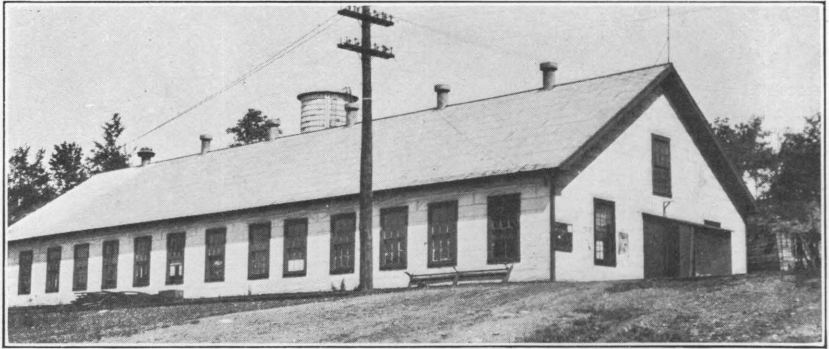
Bathtubs are not practicable for change houses, as too much time is consumed by each bather to make possible the accommodation of more than a small number of men from each shift. Tubs, with few exceptions, are left in an insanitary condition and are liable to be a means of spreading disease.

**WASH TROUGHS.**

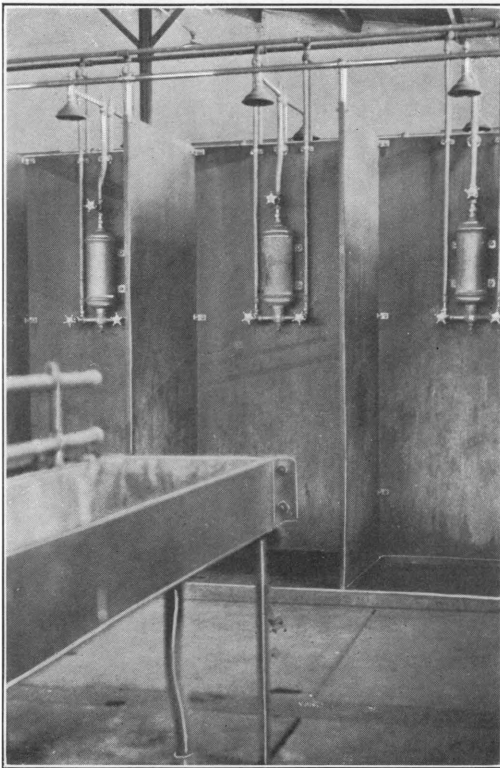
The washing equipment in the majority of change houses is in rooms built especially for that purpose, but in a few it extends along the walls or down the center of the change rooms. All washing facilities should be installed in a wash room near the change room. (Plate XII shows an arrangement of wash rooms that relieves congestion and confusion.) Wash troughs were installed in 80 per cent of the change houses visited, and sinks in the remainder. The men themselves furnished soap and towels—a satisfactory arrangement. Troughs of two styles were in use, those with a semicircular bottom and those with a flat bottom. The former predominated. Fifteen per cent of the troughs were wooden. These should be replaced by modern equipment. Wooden troughs can not be kept clean, and the water which stands in them is likely to breed disease. (See Pl. II, *A*.) Men were found to have expectorated in a few of them. Equipment that makes it possible for a few careless persons to endanger the health of others should have no place in any public building. Plates II, *B* and *C*, III, *A* and *B*, and IV, *A* and *B*, show wash troughs of different types. Seventy-five per cent of the troughs were of sheet iron and 4 per cent of cement. These materials are not recommended; they are not cleaned as easily as white-enameled iron, which is used in the remaining change houses. Its glazed surface discourages dirt from sticking and is easily cleaned with soap powders, kerosene, or common soap and hot water.

The troughs seen, ranged in width from 15 to 36 inches. Double troughs should be at least 4 feet wide, to give enough space between the sprays or faucets and the edge for washing without splashing water about. The troughs were 8 to 24 inches in depth; they should be at least 10 inches deep, so that there will be no overflow during the busiest washing periods. They stood about 3 feet from the floor, a convenient height, and were 4 to 25 feet in length, according to the washing space required. A few semicircular troughs were covered with metal screening on which basins were placed; in others the basins were held between the edge of the trough and the water pipes running down the center. Hot and cold water faucets were placed at regular intervals down the center of the trough. The drainage traps were situated either in the center or at one end, but it is advisable to place them in the center.

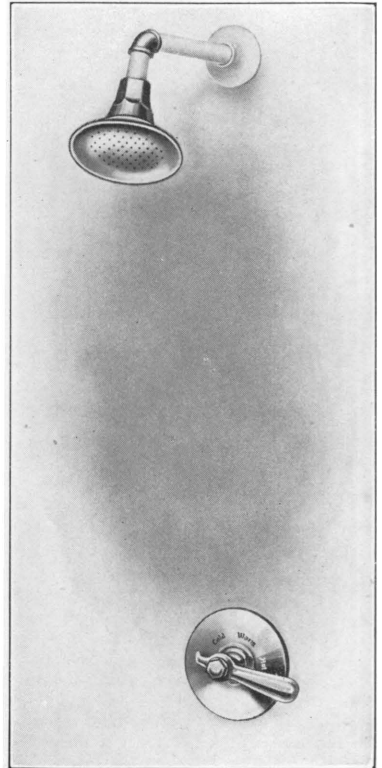
Wash-house sinks were of white-enameled iron, and only 5 per cent of those in use were of the individual type. They were about 15 inches long, 10 inches wide, and 8 inches deep; stood 3 feet from the floor; and were installed in rows along the walls or in the center of the room. Wash-room equipment of this kind is not advisable, as a large number is needed to accommodate the men from each shift,



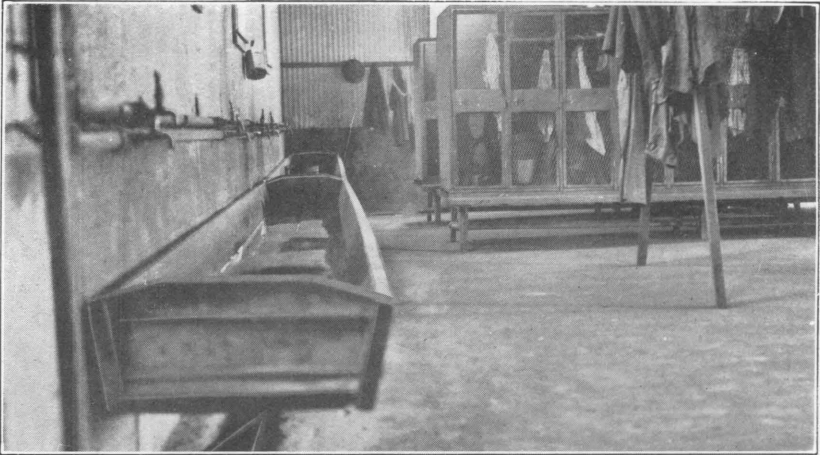
A. WELL-LIGHTED ASBESTOS CHANGE-HOUSE.



B. SHOWERS, IN OPEN STALLS, FITTED WITH MIXING CHAMBERS FOR HOT AND COLD WATER.



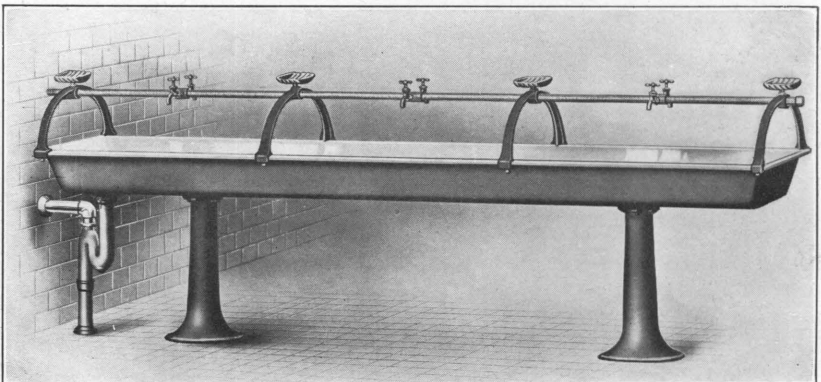
C. MIXING VALVE AND DIAL TO GIVE DESIRED TEMPERATURE OF WATER.



A. CHEAPLY CONSTRUCTED WASH TROUGH (WOOD) THAT IS DIFFICULT TO KEEP CLEAN AND IN A SANITARY CONDITION.



B. A SEMICIRCULAR WASH TROUGH WITH BASINS IN POSITION; HEATING PIPES UNDER THE TROUGH AND SHOWERS IN THE REAR.

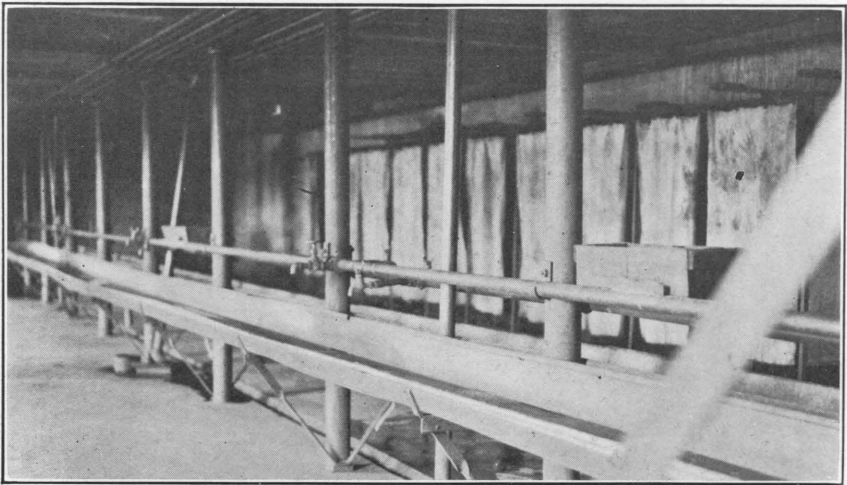


C. A DOUBLE TROUGH OF WHITE ENAMELED IRON, FITTED WITH FAUCETS.





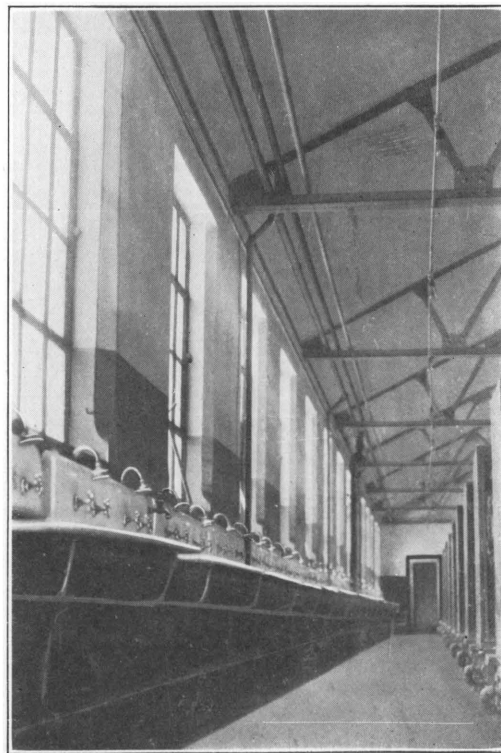
A. A SEMICIRCULAR WASH TROUGH WITH BASINS IN DRYING POSITION.



B. A SQUARE WASH TROUGH OF METAL, SHOWING FLOOR DRAINAGE-TROUGH.



**A.** A DOUBLE TROUGH OF WHITE ENAMELED IRON EQUIPPED WITH BASINS. NOTE BULLETINS IN THE REAR.



**B.** WHITE ENAMELED SINKS EQUIPPED WITH SPRAYS.

and much space is used in placing so many. Larger sinks accommodate two men and were installed in 15 per cent of the buildings. These are an improvement, as only half the number is required, with resulting economy in space. The large or double sinks were usually 4 feet long, 18 inches wide, and 6 inches deep, and stood 3 feet from the floor. Plate IV, *B*, shows white-enameled double wash sinks fitted with sprays; such sinks drain into troughs beneath them.

Basins were used in 92 per cent of the change houses, and sprays in the remainder. The mine owners provided basins in 46 per cent of these buildings, and the caretakers were supposed to keep the basins clean; but in the remaining 54 per cent they were furnished by the men, who were responsible for them. They were of all kinds, and usually very insanitary, being rusty, dirty, and excellent agents for transmitting disease. No company can afford to endanger the health of its employees, especially when the danger is as easily eradicated as this; therefore, the use of basins should be abandoned. Spray-mixing faucets will not only solve this problem, but will add much to the convenience of the men by obviating the care of basins and saving time in mixing hot and cold water to the temperature desired for washing.

Flat-bottomed double troughs of white-enameled iron, at least 4 feet wide and 10 inches deep, 3 feet from the floor, and at the center of the wash room, are recommended as superior to all other washing equipment for change houses. The length is determined by the amount of space needed to accommodate the largest number of men who will use the washing facilities at any one time. A double row of spray-mixing faucets 2 feet apart should run down the center of the trough, making it possible to utilize both sides of the trough at the same time, and giving enough room between the sprays for the men to wash without crowding. If the trough is more than 10 feet long, drainage traps should be installed at both ends as well as in the middle; if it is 10 feet or less, a trap in the middle will care for the drainage. The long white-enameled trough is cleaned much more easily and quickly than the individual or double sink. The entire trough can be scrubbed and flushed in a short time, as there are no small corners or rough surfaces to which dirt can stick. The expense of installing this type of equipment is considerably less than that for the sinks necessary to accommodate a shift of men. Plate II, *C*, shows a wide white-enameled wash trough with faucets, which are not as satisfactory as sprays.

#### LAUNDRY TUBS.

Less than half of the change houses had laundry tubs for the men to use when washing shirts, underclothes, and soiled working clothes. All buildings should be so equipped as a convenience for men of

cleanly habits, and as an incentive to others to keep their clothing tidy. The tubs were installed at various places, such as the wash, change, and latrine rooms; but they should be placed either in the wash room or near it, so that all washing equipment is concentrated. Metal tubs are most common. Cement, porcelain, stone, and slate combination tubs are also much in evidence. In two of the change houses portable wooden tubs were used. White enameled-iron tubs are recommended, as they look neat and are more easily cleaned than those of other materials.

Six tubs should be provided for every 100 men employed. They should be permanently fixed either in the wash room or near it. (See Pl. XII.) A tub of white-enameled iron, with a back extended up at least 1 foot to protect the walls, is recommended. Ample hot and cold water and a rubber plug for the drainage outlet should be supplied. One washboard should be furnished for each tub.

#### DRINKING FOUNTAINS.

Only 15 per cent of the buildings visited were equipped with drinking fountains; the remainder used upturned faucets which are turned on and off by the men. Sanitary equipment for obtaining drinking water should be in every change house. The greatest number of disease germs enter the body through the mouth; it is therefore important that whatever the mouth touches should be free from those germs. There is nothing to prevent the mouth from coming into direct contact with an upturned faucet; hence such equipment becomes dangerous as a potential transmitter of disease and should be replaced by sanitary drinking fountains.

A drinking fountain of the best type throws a moderate stream of water slightly outward and upward and may be operated by a push valve. It ought to have a circular nickel guard around the water opening to prevent direct contact. There should be at least two fountains in every change house. Plate V, *A*, *B*, and *C*, shows a drinking fountain of pedestal type, one of wall type, and one with a ring over the orifice.

#### LATRINES.

One-third of the change houses inspected lacked latrine facilities. These were old buildings and should be replaced by modern structures with sanitary equipment. In 12 per cent of the change houses the latrines were in poor repair, with seats missing, and other parts loose, gone, or decaying. Such conditions should not exist.

Latrines in all of the buildings visited were placed in wooden or metal stalls standing on 12-inch legs, and 5 feet high; most of them were entered through swinging doors. All latrines should be inclosed and supplied with doors, for privacy. Some change houses had

latrines in the wash or shower rooms, while others had special latrine rooms. It is advisable to have a room especially for latrines, since it is necessary that the air be changed frequently where they are used and drafts from open windows would be dangerous to men who are undressed for washing and bathing.

Two general types of latrines—the individual and the trough—are in use in the change houses of the Lake Superior region. The individual type, usually with a metal or porcelain bowl on which rests a wooden seat, was found in 89 per cent of the buildings that had latrine facilities. Metal seats were also found, but are not recommended, as they are likely to be cold and uncomfortable. The individual latrine is flushed automatically or by hand. One-third of the individual latrines were arranged in batteries of 4 to 12. In a battery the latrines are placed at regular intervals on a pipe about 8 inches in diameter, and the entire group is flushed automatically every 10 or 15 minutes.

Trough latrines were installed in 11 per cent of the buildings that had latrine facilities. These are merely wooden troughs divided at regular intervals by partitions. The trough is sometimes covered by boards in which holes have been cut for seats. At two wash houses no seats were provided and the edge of the trough was used for that purpose. Such latrines are continuously and automatically flushed but even this constant flushing does not entirely free wooden troughs from excretions. Latrines of this type are highly insanitary, are frequently in an objectionable condition, and should be replaced by modern equipment. No company should permit the retention of such antiquated equipment.

Three types of flushers were noted—the hand, the intermittent automatic, and the continuous automatic. Thirty-three per cent of the latrines were flushed by hand, but this is unsatisfactory, as some of the men are always careless and excretions are likely to be left in the bowls—a practice to be overcome only by the installation of automatically flushed latrines. Forty-two per cent of the buildings were equipped with automatic flushers of the intermittent type, which flushed at 10 or 15 minute intervals. They are not recommended, however, as excretions may stand in the bowls for the entire period between flushings. The remaining 25 per cent had automatic flushers which operate continuously. These are very satisfactory, but should not be installed if economy in the use of water must be observed. The latrine that is flushed at the release of the seat is as satisfactory as that continuously flushed, and uses far less water in operation.

Individual latrines (Pl. VI, *A*), inclosed in metal stalls (Pl. VII, *B*), are recommended for change houses. Those arranged in batteries

are satisfactory only when flushed continuously. Bowls should be of porcelain, as they are more easily kept sanitary than metal. Serpentine or extended-lip, open-front seats, make the transmission of disease less possible. (See Pl. VI, *B*.) Such materials as "whale-bone-ite" or "ebonite" should be used for seats, as they are impervious to water and antiseptics. The frequent scrubblings necessary to keep the seats clean may decay ordinary wood. The latrine should be either automatically flushed upon the release of the seat or be continuously flushed.

#### URINALS.

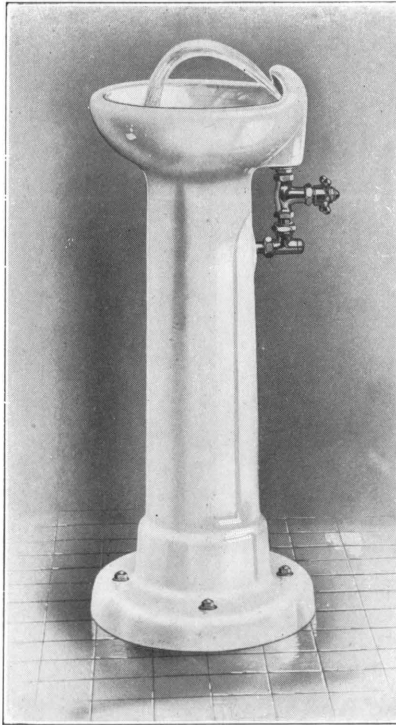
Sixty-six per cent of the change houses inspected were provided with urinals, but all should be so equipped as it is difficult to keep latrine seats sanitary when the men have to use latrines for that purpose. Seventy per cent of the urinals were inclosed in metal stalls. Floor urinals were used in 35 per cent of the buildings supplied with those facilities. Eighty-five per cent of the urinals were of white-enameled-iron construction, 10 per cent of porcelain, and the remaining 5 per cent of wood. Wooden urinals which are very unsatisfactory and insanitary, were found only in the oldest buildings. Porcelain was used only in individual floor urinals. This type is not recommended, as one or two will not suffice for a change house accommodating many men, and if provided in larger numbers they require too much space. Urinals at floor level are difficult to keep clean, and too often serve as catchalls for refuse. There is also more possibility of splashing than when trough urinals are used.

Trough urinals were found in 65 per cent of the buildings with urinal facilities. The troughs stand about 3 feet from the floor and are 12 inches wide, 10 inches deep, and 4 to 12 feet long. All multiple urinals slope toward one end, where the drainage trap is placed. Urinals of this type inspected were all automatically flushed, 62 per cent at 10 or 15 minute intervals, and 38 per cent continuously. Urinals must be continuously flushed to remove excretions properly.

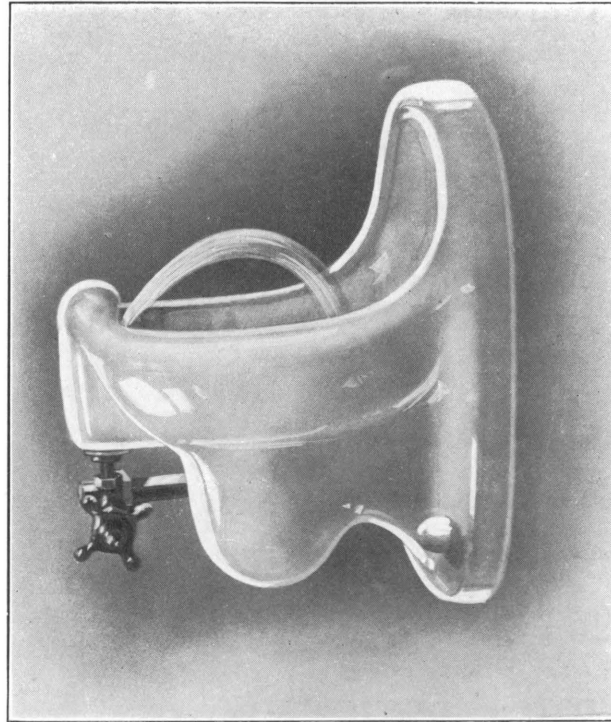
Trough urinals (see Pl. VII, *A*) are recommended for use by a number of men. They can be washed out more thoroughly and in less time than individual and floor urinals. The back of each trough should extend up at least 15 inches to prevent splashing of the walls. Each trough should have a slope of three-fourths inch to every foot in length toward the drainage trap, and should be flushed continuously. White-enameled iron is undoubtedly the best material for the troughs.

#### LOCKERS.

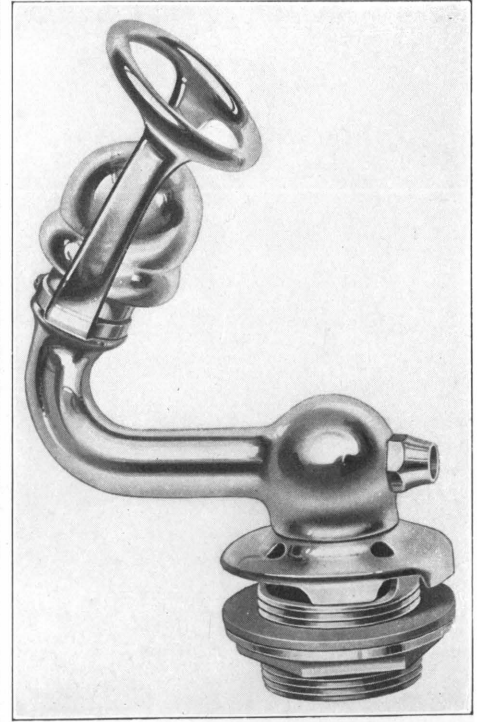
Lockers in all of the buildings investigated were placed in the change rooms, either around the walls or in double rows through the center. Ninety per cent were of steel, and the remainder of wood. Wooden



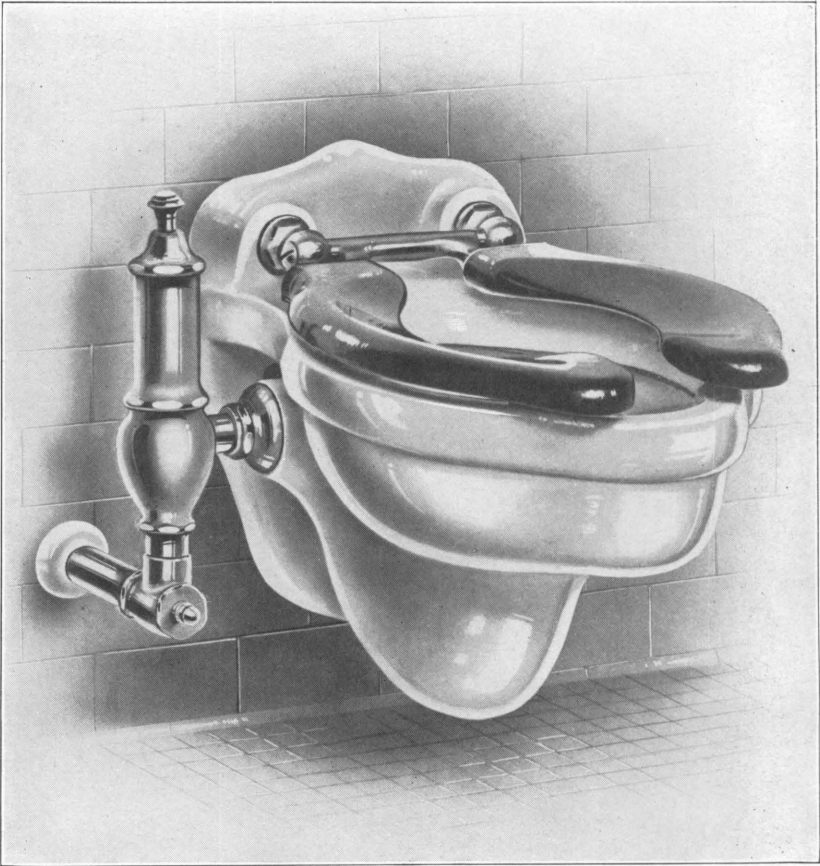
A. DRINKING FOUNTAIN OF PEDESTAL TYPE.



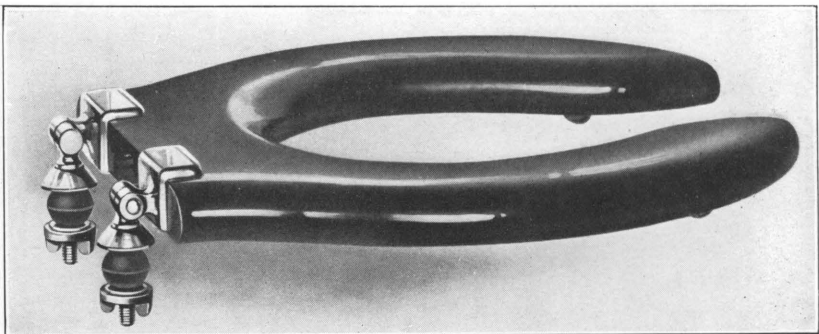
B. DRINKING FOUNTAIN OF WALL TYPE.



C. FOUNTAIN FIXTURE WITH RING OVER ORIFICE.

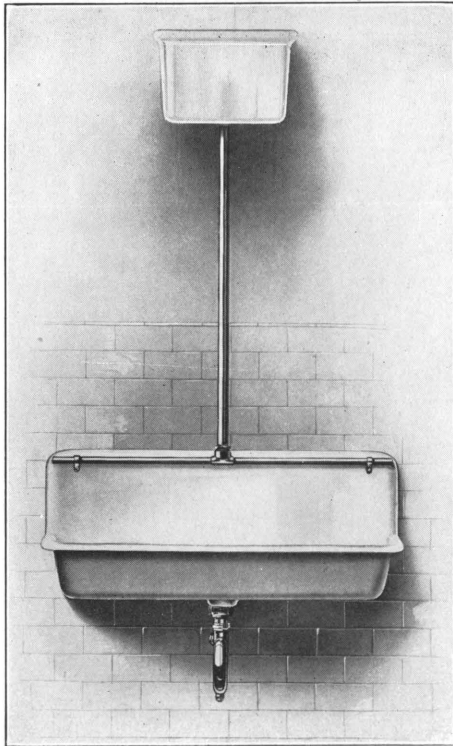


A. INDIVIDUAL TYPE OF LATRINE.



B. SERPENTINE OPEN-FRONT SEAT FOR LATRINE.

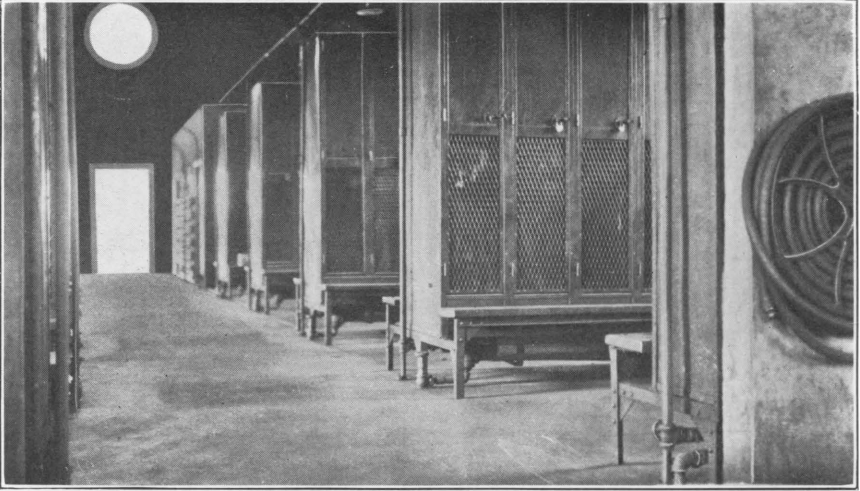




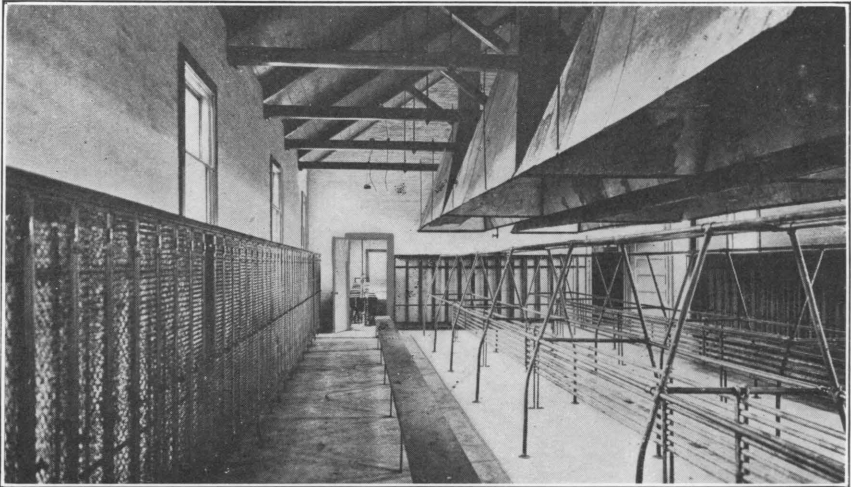
**A.** TROUGH-TYPE URINAL OF HEAVY ENAMELED IRON, WHICH CAN BE MADE IN ANY LENGTH.



**B.** METAL STALLS FOR LATRINES.



4. DOUBLE-COMPARTMENT LOCKERS. INCLOSED UPPER COMPARTMENT FOR STREET CLOTHES, AND SCREENED LOWER COMPARTMENT FOR WORK CLOTHES.



B. A DRYING RACK OF IRON. NOTE STEAM PIPES AND SHEET-IRON VENTILATING HOODS.

lockers should be replaced by steel ones, which are less difficult to keep clean and are fireproof. Steel lockers are of two sizes, those 60 to 72 inches in height, and those but 36 inches. The small lockers are not practical for change houses, as they are not roomy enough to hold the many things that must be kept in them. The large lockers inspected differed considerably in construction. Forty-four per cent were solid with metal screen doors; 30 per cent were all-metal-screen work; 10 per cent had perforated sides and doors; and another 10 per cent had solid upper parts and lower parts of metal screening, as shown by Plate VIII, *A*. The remaining steel lockers—6 per cent of the total noted—were divided to keep work and street clothes separated. The entire locker should be of metal screening for ventilation and inspection.

Double-compartment lockers should always be used in change houses where no drying racks or chains are furnished, as work and street clothes should never be kept together. The street clothes gather odors and dirt from the work clothes. This is the practice in over 50 per cent of the change houses, but should not be permitted. All the lockers seen had perforated bottoms, averaged 12 to 18 inches in width by 10 to 15 inches in depth, and rested on 15-inch metal frames.

In nearly two-thirds of the buildings, the work clothes were kept in lockers, without artificial ventilation and adequate drying facilities. Steam pipes underneath lockers do not dry wet or damp clothes efficiently nor adequately. Unless lockers are artificially ventilated and equipped with drying apparatus, drying racks or chains should be supplied for work clothes. Change houses equipped with drying racks or chains should have lockers 60 inches high, 12 inches wide, and 15 inches deep. If work clothes are kept in the lockers instead of on drying racks or chains, a double-compartment locker at least 6 feet high should be installed, and equipped with an artificial ventilating and drying system of the type described on page 16.

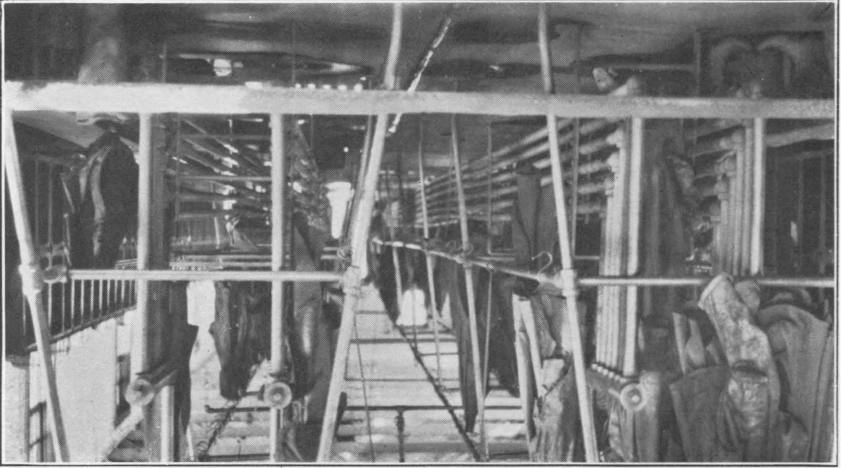
Less than one-fifth of the lockers inspected were kept in a sanitary condition; the remainder were filled with old, dirty clothes and rubbish of all kinds which not only made the change house untidy but provided breeding places for germs of all kinds and attracted insects, such as cockroaches. (A successful method of eliminating these pests is described on page 20.) The presence of cockroaches in some change houses is due primarily to the insanitary condition of the lockers, so these should be inspected daily by the caretaker, who should insist that they be kept in good condition always. It will be difficult to enforce this regulation unless the lockers are large enough and furnished with enough hooks to accommodate the clothes kept therein.

**DRYING RACKS.**

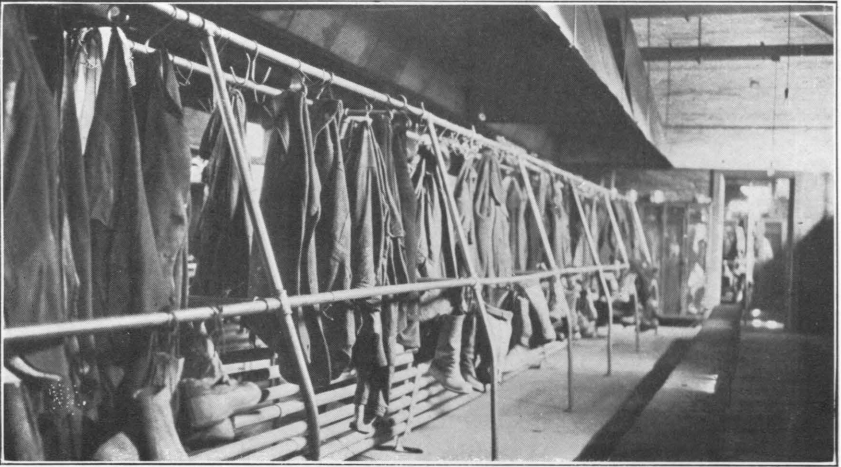
One-fourth of the change houses had racks for drying work clothes. These were sanitary, convenient, and much liked by the men. The majority were of iron, the remainder of wood. The latter are not recommended, owing to the danger of fire. The iron racks were made of 1-inch pipes, most of which were 5 feet wide at the base, 20 inches wide at the top, and 7 feet high. Their length depended upon the amount of available space and the number of men to be accommodated. Three pipes ran the full length of each side to which were attached the hooks on which the work clothes were hung. The first pipe was usually placed 3 feet from the floor, the next 4 feet, and the next at the top of the rack. One or two rows of steam pipes were placed inside the rack, near the floor, and ran its entire length. It is advisable to have two rows of steam pipes—covered with metal screening to protect the clothes—in order to dry the clothes thoroughly. Ventilating hoods, to carry off the odors, were placed above the racks and connected with the roof-ventilating monitors. Over each rack should be a sheet iron hood from the top of which a pipe runs to a large or common pipe terminating in a fan that vents to the outside. The hot air rising from the steam pipes below the drying racks would carry with it the odors from the work clothes, and would pass from the hood into the pipe and out through the common pipe. Plates VIII, *B*, and IX, *A* and *B*, are views of a pipe rack in use at one mine.

Eight per cent of the change houses inspected used chains instead of drying racks. These were placed in separate rooms designated as chain rooms, and were fastened at the top to the rafters and at the bottom at a point about 6 feet from the floor, to either steel or wood frames. A few were fastened to metal rails, 3 feet from the floor. The chains were placed in rows, alternating with rows of steam pipes 9 to 10 feet from the floor. The hooks on which the clothes hang were attached to the upper part of the chain. If a man wished to dry his clothes, he had to unfasten the lower end of the chain from the rail and lower the hooks by a pulley. After the clothes were put on the hooks, the chain was pulled up so that the clothes were above the steam pipes, where they were dried by the heat arising therefrom. This system is more complicated and takes much more time than the drying rack system; it is in disfavor at some places in the Lake Superior region on account of the small clothes hooks and the chains catching in the pulleys. Plate X, *A*, shows a change house equipped with chains.

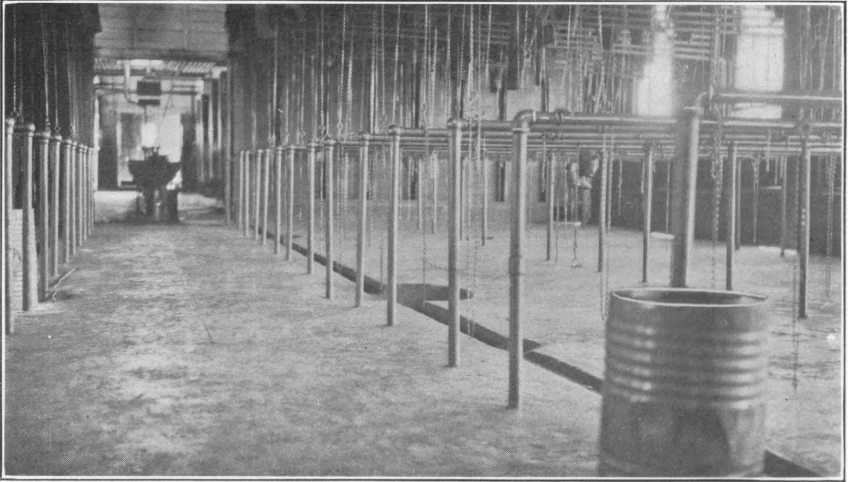
Drying racks should be supplied unless work clothes are kept in lockers arranged with a good artificial ventilating and drying system. The center of the locker room is a convenient location. The rack should be constructed of 1-inch iron pipes; satisfactory dimensions



A. END VIEW OF DRYING RACK.



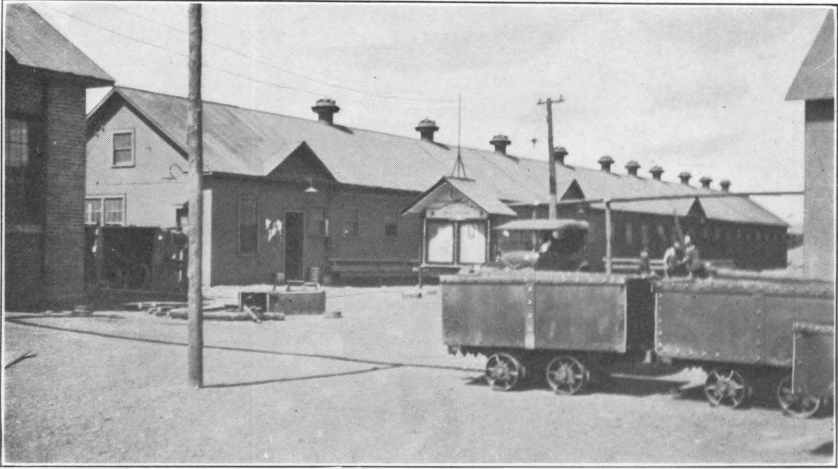
B. DRYING RACK IN USE.



**A.** IRON-PIPE RAILS FOR LOWER ENDS OF CHAINS. NOTE ALSO ARRANGEMENT OF STEAM PIPES, DRAINAGE TROUGH IN FLOOR, AND EMPTY CARBIDE CAN FOR REFUSE.



**B.** A BRICK CHANGE HOUSE WITH A RUBBEROID ROOF AND SANITARY SURROUNDINGS.



**A.** A CHANGE HOUSE OF CORRUGATED IRON. THE LARGE BULLETIN BOARD PLACED NEAR THE ENTRANCE IS A COMMENDABLE FEATURE.



**B.** A CHANGE HOUSE OF BRICK WITH A CORRUGATED-IRON ROOF. LONG WOODEN VENTILATING MONITOR AND SMALL VENTILATORS OF SHEET IRON.





are 5 feet wide at the base, 20 inches wide at the top, and 7 feet high. Two rows of steam pipes should be placed near the floor and run the full length of the rack, one on either side. A sheet-iron hood should be placed over the rack, from which a pipe runs to a common pipe which terminates in a fan that vents to the outside. (See the section of a locker room in Pl. XII for this arrangement.)

#### **BENCHES.**

Benches for the men to use while dressing were provided in the change and locker rooms at all of the mines visited. Ninety per cent of the benches were made stationary by being fastened to the frames supporting the lockers; the remainder were movable. All benches should be made fixtures, to obviate the danger of their tipping while the men are dressing and to facilitate keeping them in their proper places. Locker rooms in which the benches are promiscuously scattered about look very untidy. In the change houses of the Lake Superior region there was usually one row of benches before each row of lockers in the center of the room and another in front of the lockers along the walls. The benches were of wood and were about 15 inches wide, 2 inches thick, and as long as the rows of lockers in front of which they stood. Steel benches are recommended in preference to those of wood because they are more easily kept free from ore, mud, and dirt and are more durable. Such benches should be 12 inches wide, 15 inches high, and as long as the rows of lockers. The steel legs should be not more than 6 feet apart and fixed to the floor.

#### **FIRST-AID ROOMS.**

About a third of the change houses visited had first-aid rooms. The larger companies that had no first-aid rooms in their change houses have made provision for them in other buildings. Most of the rooms provided for this purpose were well lighted and ventilated and were properly equipped with Army and Navy stretchers, chairs, tables, and supplies, and with hot and cold water. Companies that employ first-aid men as caretakers utilize their training in the treatment of simple wounds, under the direction of the company physicians. All men so badly injured that they must be sent to the hospital receive first aid. Well-equipped first-aid rooms are essential to all changes houses, as such houses are peculiarly adapted to the purpose of a room of this sort, on account of being conveniently near the shaft and supplied with hot and cold water at all times. (See Pl. XII.)

#### **ROOMS FOR MINE FOREMAN AND SHIFT BOSS.**

Rooms for the mine foreman were found in about two-thirds of the change houses, and for the shift boss in one-third; but in the remaining buildings no provision was made for either. Such rooms were

fitted with lockers, latrines, wash sinks, and showers. Desks were provided for mine foremen and sometimes for shift bosses. The change house is recommended as the best place for the offices of the mine foreman and shift boss, as it limits the plumbing equipment to one building, brings the mine foreman and shift boss in closer touch with each other and with the men, and puts the men more at ease in discussing their problems with them. (See Pl. XII.)

#### CARBIDE STORAGE.

Carbide was handled in 75 per cent of the change houses visited. In half of these it was stored in a small closet, with a place or recess for each miner's supply. The caretaker kept a full can of carbide in each recess, and distributed the cans just before the men went on shift. In other change houses where carbide was handled, carbide cans were placed in the passageways and the men helped themselves.

Carbide should not be kept in a change house, because it increases fire hazards. Moreover, it has a disagreeable odor, and the powder from the lamp rejects is scattered about and is difficult to remove from the equipment and floors. At a few mines small fireproof buildings were used for carbide storage. This arrangement is recommended as satisfactory when the building is near the change house. Only a few companies had rules against lighting and emptying carbide lamps in the change house. This practice should be prohibited, and cans for the lamp rejects should be placed at the entrances of the building.

#### CARETAKERS.

The proper functioning of a change house depends largely upon the caretaker's efficiency. A large proportion of the companies in the Lake Superior region seemingly did not realize the importance of employing men qualified for the work. Eighty-three per cent of the caretakers employed were untrained in first aid and sanitation; most of them were physically disabled old men unable to work in the mines, who had been virtually pensioned by the companies. The fact that men who are unable to do any other type of work are used as caretakers, gives employees the impression that the sanitation and general care of the change house is unimportant. Under those circumstances it is difficult for a caretaker to enforce rules and regulations. Untrained caretakers are unaware of the importance of sanitary regulations; in fact, at many change houses where stringent rules against expectorating were supposed to be in force, the caretakers themselves were among the worst offenders.

Seventeen per cent of the caretakers had been trained in first aid and sanitation, and all but two of these were very efficient. All caretakers should be trained in first aid and sanitation, as the entire

responsibility of the change house and its equipment falls upon them during their periods of duty, and occasionally they may have to meet emergencies that call for prompt action along these lines. Caretakers trained in first aid can assist company surgeons in the care of minor wounds. If the companies desire to employ "pensioners" they should be given such instruction in sanitation and first aid as will qualify them for the position.

A caretaker was employed for each shift at most mines; this is recommended in order that the building may be thoroughly cleaned and properly put in order after each period of use. An occasional inspection of the change house by the company surgeon, who is vested with power to enforce strict sanitary regulations, is a great incentive toward more thorough work by the caretaker.

#### SANITATION.

Too much stress can not be placed upon the importance of maintaining sanitary conditions. On account of the peculiar functions of a change house a great deal of dirt, and germs of almost every variety are brought into it. The high temperature and humid atmosphere of all change houses are favorable to the rapid growth and increase of germs and can be counteracted only by careful and persistent sanitation. It may again be emphasized that a change house should be cleaned thoroughly after each shift.

When the cleaning is to be done, it is well first to sweep up all rubbish and visible dirt to avoid clogging the drainage traps; then the hose can be used to good advantage in flushing the entire floor. The water is easily swept to the floor traps, which should be adequate in number and arrangement to drain it off in a few minutes. In many change houses so much of the caretaker's time is consumed in scrubbing floors that he necessarily neglects other work. Flushing the floor at a change house at one mine was solved by placing a 1-inch pipe, perforated every 4 inches, along the side walls near the floor, and connecting it with the hot-water pipes. After the caretaker had swept the floor, he turned on the hot water and in a few moments the entire floor was flushed. In this particular wash house, the floors sloped from the walls toward the center of the room, where drainage traps were placed, which cared adequately for the waste water. This arrangement is simple and inexpensive, and one that may be easily installed in any change house.

Latrines, urinals, stalls, wash-troughs, sinks, and basins should be thoroughly washed after each shift; the three first may be sluiced with the hose when the floor is flushed. Wash troughs, sinks, and basins should be scrubbed out with either soap powder, kerosene, or ordinary soap and hot water. These adjuncts to the change house should also be thoroughly cleansed with an antiseptic solution, such

as cresol or chloride of lime, at least once a week. It is also advisable at the same time to scour the shower and spray heads and nickel-plated faucets with a soap powder or kerosene. The tops and interiors of the lockers should be washed with kerosene at least once every two weeks. Lockers should be inspected daily and only necessary clothing allowed to remain in them. On account of the accumulation of dust, the lighting facilities are considerably impaired unless the windows and electric-light bulbs are cleaned at least once a month. The cans for rubbish, which are placed in the change, latrine, and first-aid rooms, as well as in all passageways and near all outside entrances of a well-equipped change house, should be kept covered and should be emptied at least once a week. They also need thorough scouring once a month.

Cockroaches give considerable trouble in some change houses. These pests were eradicated from one house in the Lake Superior region in a novel way that could be used in any building situated where freezing weather is experienced. During the Christmas holidays, all the steam and water pipes in the change house were disconnected and drained, the heat turned off, and the windows and doors left open for three days. The cockroaches disappeared entirely, and for over a year the company experienced no more trouble from them.

Any practice that endangers health should be stopped by stringent rules, vigorously enforced. Different change houses will require different regulations, depending upon the habits of the employees. Expectorating in change houses is a practice common to nearly all miners. Every change house should have a rigidly enforced rule against expectorating in or about the building. Caretakers must be made to realize the danger of transmitting disease by this means, and be given authority enough to stop it. Heavy metal spittoons might serve to check promiscuous expectorating. They should be rinsed out after each shift and a little cresol solution allowed to remain in them.

## **RECOMMENDATIONS FOR THE LAKE SUPERIOR REGION.**

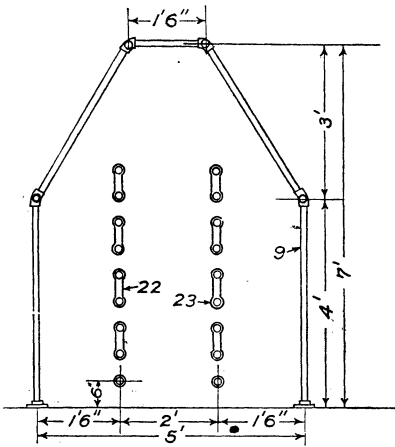
### **CONSTRUCTION.**

Change houses should be constructed of concrete blocks or brick, with a roof of tile or other noncombustible material.

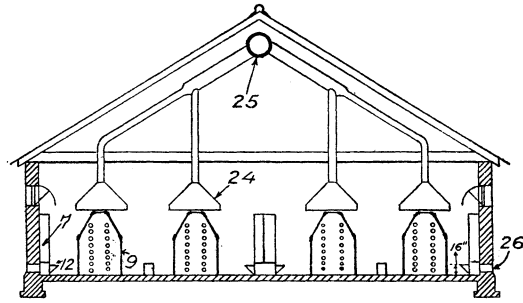
### **RUNWAYS AND TUNNELS.**

1. Change houses should be convenient to the mine shaft, and be connected to it by an underground tunnel or an inclosed surface runway.

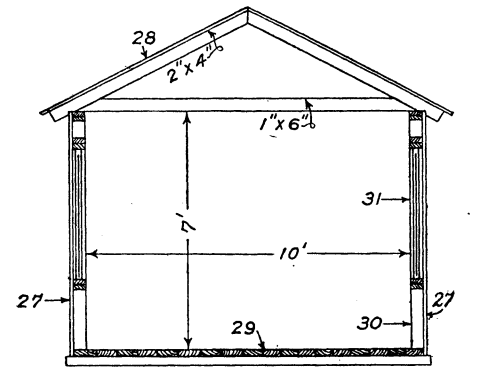
2. The tunnel or covered surface runway should be adequately heated and lighted and equipped with fire doors at both entrances.



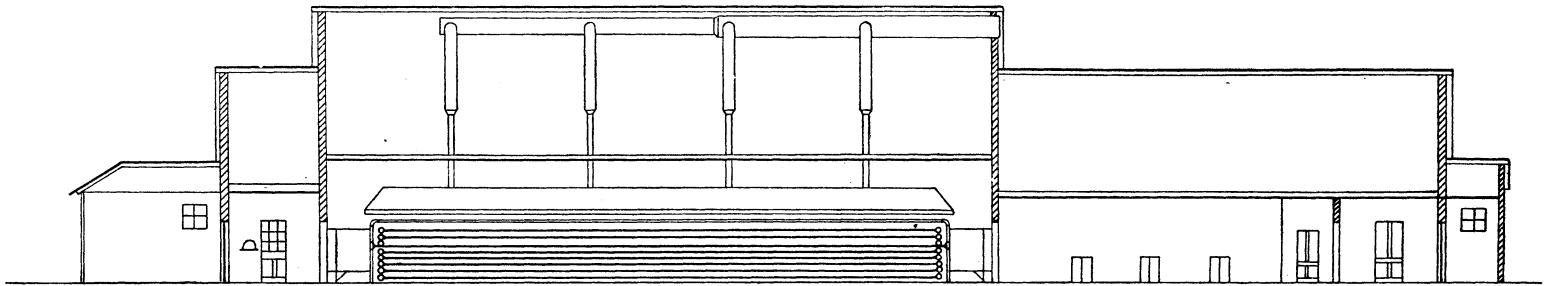
SECTION OF CLOTHES RACK



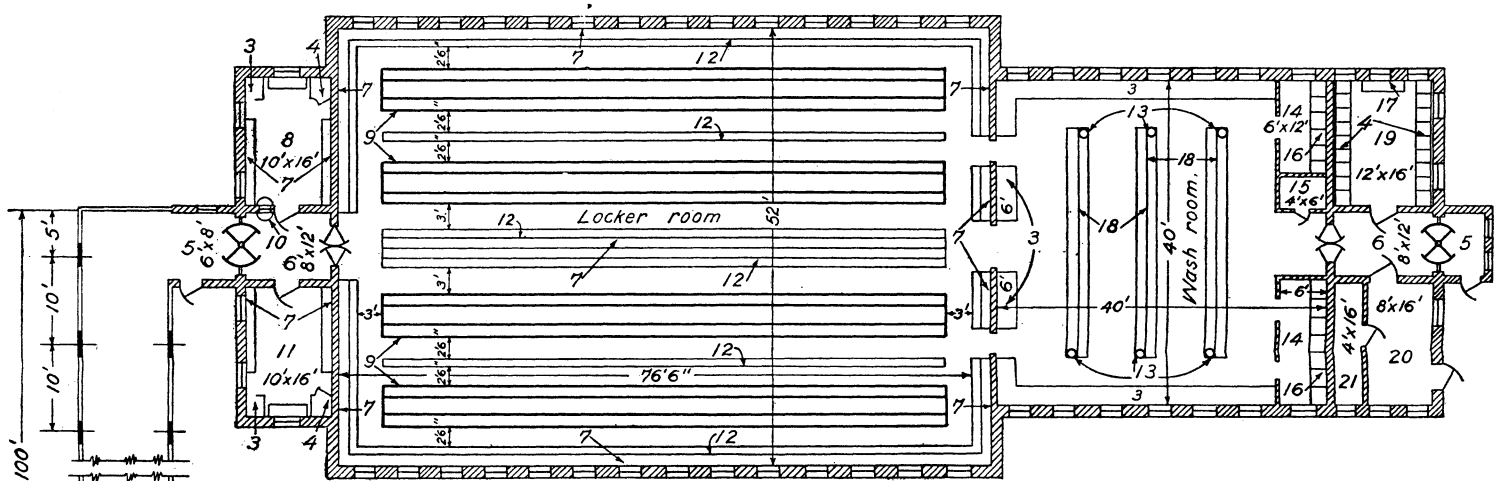
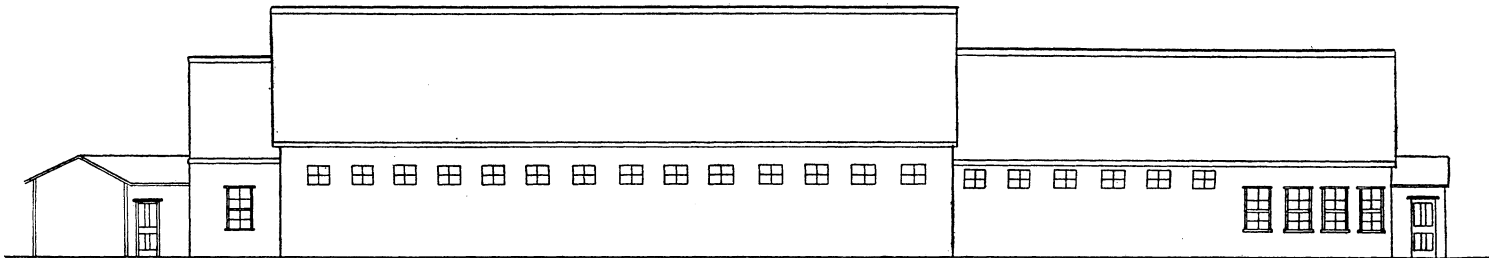
SECTION THROUGH LOCKER ROOM



SECTIONAL ELEVATION OF SURFACE TUNNEL



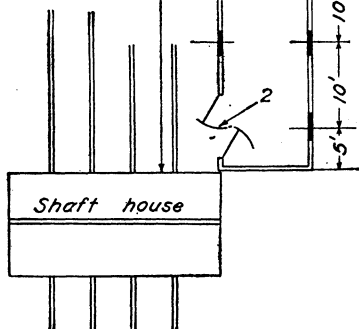
LONGITUDINAL SECTION OF CHANGE HOUSE



DETAILS OF A MODEL CHANGE HOUSE: 1, SURFACE TUNNEL; 2, DOUBLE DOORS, 8 FEET; 3, SHOWERS; 4, LATRINE; 5, ENTRANCE; 6, PASSAGE; 7, LOCKERS; 8, SHIFT BOSS'S ROOM; 9, CLOTHES RACK; 10, CHECKING WINDOW; 11, CAPTAIN'S OFFICE; 12, BENCH; 13, SANITARY DRINKING FOUNTAINS; 14, LAUNDRY ROOM; 15, DRY-MAN'S CLOSET; 16, LAUNDRY TUBS; 17, URINAL; 18, WASH TROUGH; 19, LATRINE ROOM; 20, FIRST-AID ROOM; 21, FIRST-AID CLOSET.

SPECIFICATIONS.

Locker room contains 324 lockers 60 inches high, 12 inches wide, 15 inches deep. Day-shift men use odd-numbered lockers; night-shift men use even-numbered lockers. Lockers should be openwork throughout and have sanitary base. Benches should be steel, 12 inches wide and 15 inches high; benches and lockers to be attached thereto. Laundry contains 12 laundry tubs of enameled iron. Windows in lockers, wash and latrine rooms, and entrances are single sash, 2 feet 6 inches by 2 feet 6 inches, hinged at bottom and swinging inward, 8 feet from floor. Double-hung, check-rail windows in first-aid, captain's, and shift boss's rooms. Sprinkler heads of showers to be 4 feet apart. Floors should pitch to bell-trap drains. If mine uses steam, exhaust steam is used to heat change house; otherwise a heating unit must be installed in basement.





**ENVIRONS.**

1. Surroundings should be sanitary. A well-kept lawn planted with shrubbery should surround the change house.

2. Covered cans for rubbish should be put at the entrances of the change house to discourage the throwing of paper, carbide-lamp rejects, and other waste about the grounds.

**SEWAGE DISPOSAL.**

1. Sewage should not be discharged into streams which are used for drinking water farther down their courses.

2. Cesspools should be used only if they are constructed and operated scientifically, and if there is no danger of contaminating drinking water.

3. Septic tanks should be used whenever possible; if carefully built they dispose of human waste in a satisfactory way.

**ARRANGEMENT OF INTERIOR.**

1. Rooms should be of ample size and conveniently arranged. Equipment should be concentrated and placed in the order in which it is used.

2. Enough equipment should be provided to accommodate all the men employed on a shift.

**FLOORS AND WALLS.**

1. All floors should be cement, kept in good repair.

2. Traps adequate to drain off waste water should be placed in the center of the room, with the floors sloping toward them.

3. Walls should be brick, painted a dark color for a height of 5 feet and from there up a lighter color.

**VENTILATION.**

1. Enough windows, roof ventilating monitors, and vents should be supplied to allow thorough air flushing.

2. The building should be air flushed several times daily.

3. Lockers should be artificially ventilated if work clothes are kept in them.

4. Racks should be artificially ventilated if used to dry work clothes.

5. Roof ventilating monitors add to any ventilating system, and are absolutely necessary if no artificial ventilating system is in use.

6. Windows should be about 30 inches square and about 7 feet from the floor. They should have hinged bottoms and chains at the top to limit the opening. To facilitate opening, a metal ring or hook into which the window pole will easily fit should be at the top of the window.

**LIGHTING.**

1. Enough windows should be provided to light the change house properly.
2. Electric droplights, properly located, should be installed to facilitate washing, bathing, and dressing during each change of shifts.

**ENTRANCES.**

1. The outside doors should be large enough to facilitate air-flushing and allow the easy passage of many men in a short time.
2. Revolving doors should be used for outside entrances to avoid drafts.
3. Storm inclosures should be supplied for outside entrances in winter.

**HEATING.**

1. The temperature should be maintained at between 75 and 80° F. so that the men will be able to bathe in comfort.
2. If it is necessary to have a furnace in a change house, it should be installed in the basement. A special furnace room should be constructed if there is no basement.
3. All steam and hot-water pipes so placed that men may knock against them should be covered with metal screening, as a protection against burns.

**BATH EQUIPMENT.**

1. Showers rather than tubs should be supplied, as they are more sanitary, better adapted to use by large numbers, and stimulate the skin to eliminate wastes.
2. One shower should be provided for each 10 men in a shift.
3. Showers should be uninclosed, for they are then more easily kept in proper condition.
4. All showers should be equipped with mixing valves and indicator dials.
5. Drainage traps should be placed either at the front or back of shower floors.
6. Shower floors should be of cement, as it is durable and easily cleaned.
7. Shower walls should be cemented up 7 feet.
8. Showers should be placed in the same room as the wash troughs, so that wash equipment is concentrated.

**WASH TROUGHES.**

1. Wash troughs or sinks should be placed down the center of rooms devoted to washing equipment.
2. Such equipment should be constructed of white enameled iron, because it is easy to keep clean.



3. A flat-bottomed double trough, at least 4 feet wide, 10 inches deep, 3 feet from the floor, and long enough to accommodate the men in a shift, should be used instead of individual portable basins. A double row of spray-mixing faucets, 2 feet apart, should run down the center.

#### LAUNDRY TUBS.

1. Laundry tubs should be placed in all change houses, either in the wash room or near it.

2. Six tubs should be supplied for every 100 men.

3. A stationary tub of white enameled iron should be used, with a back extended up at least 1 foot, to protect the walls.

4. Tub should be supplied with hot and cold water and a rubber plug for the outlet.

5. A wash board should be furnished for each tub.

#### DRINKING FOUNTAINS.

1. All change houses should have sanitary drinking fountains.

2. A fountain that throws a moderate stream of water slightly upward and outward and has a circular nickel guard around the water opening, to prevent direct contact with the lips, is the best type for a change house.

#### LATRINES.

1. All change houses should have latrines.

2. Latrines should be grouped in a special room that can be easily and thoroughly ventilated, and be inclosed in metal stalls with swinging doors.

3. Latrines should be washed after each shift, and cleansed thoroughly with cresol or chloride of lime at least once a week.

4. Latrines should be kept in good repair.

5. Latrines should be of the individual type, equipped with a porcelain bowl and an open-front seat with extended lips of whale-bone-ite or ebonite. They should be flushed automatically when the seat is released.

#### URINALS.

1. All change houses should be supplied with white-enameled iron urinals of the trough type, that slope toward the drainage end three-fourths inch to each foot, and are supplied with automatic continuous flushers.

2. Urinals should be thoroughly washed after each shift, and cleansed with cresol or chloride of lime at least once a week.

3. The back of the urinal should be extended up at least 15 inches to prevent splashing the walls.

### LOCKERS.

1. All lockers should be made of metal screening to facilitate ventilation and inspection.

2. Double-compartment lockers should be supplied if drying racks or chains are not in use, as street and work clothes should never be kept together.

3. Unless lockers are arranged for an artificial ventilating and drying system, racks should be provided for drying work clothes.

4. Change houses supplied with drying racks or chains should have lockers 60 inches high, 12 inches wide, and 15 inches deep.

5. Lockers for work clothes should be at least 6 feet high, 12 inches wide, and 15 inches deep, and be divided into upper and lower compartments.

6. The caretaker should inspect lockers daily and insist that they be kept neat.

7. The tops and insides of the lockers should be washed with kerosene every two weeks at least.

### DRYING RACKS AND CHAINS.

1. All drying racks should be iron. Wooden racks should be abandoned to reduce the fire hazard.

2. At least two rows of steam pipes should be placed under the racks to dry the clothes thoroughly.

3. Sheet-iron ventilating hoods should be placed over the racks. Pipes should run from the tops of these to a large common pipe, which terminates in a fan venting to the outside.

4. Drying racks, not chains, are recommended for buildings that do not have lockers suitable for work clothes.

### BENCHES.

1. A bench for men to use while dressing should be permanently attached in front of each row of lockers.

2. Benches should be of steel, 12 inches wide, 15 inches high, and as long as the row of lockers in front of which they stand. The steel legs should be placed not farther than 6 feet apart.

### FIRST-AID ROOMS.

Every change house should have a well-equipped first-aid room.

### ROOMS FOR MINE FOREMAN AND SHIFT BOSS.

Rooms should be provided for the mine foreman and the shift boss to concentrate plumbing and bring these officials into closer contact with each other and with the men.

**CARBIDE STORAGE.**

1. Carbide should never be stored in a change house.
2. The filling, lighting, and emptying of carbide lamps in a change house should be forbidden.
3. Cans should be placed at the entrances for the residue from carbide lamps.

**CARETAKERS.**

1. All caretakers should be trained in first aid and sanitation.
2. A caretaker should be supplied for each shift.
3. The company surgeon should inspect the building occasionally as an incentive to better work by the caretakers.

**SANITATION.**

1. A change house should be cleansed thoroughly after each shift. Floors, latrines, stalls, urinals should be washed by a hose; and wash troughs, sinks, and basins scrubbed with soap powder or kerosene.
2. Latrines, urinals, and wash troughs should be scoured with cresol or chloride of lime at least once a week.
3. Shower and spray heads and nickel-plated faucets should be scoured with soap powder or kerosene at least once a week.
4. The tops and insides of lockers should be washed with kerosene at least every two weeks.
5. Windows and electric-light bulbs should be cleaned at least once a month.
6. All waste cans should be emptied at least once a week and thoroughly cleaned once a month.

**A MODERN CHANGE HOUSE.**

A modern change house that attempts to meet the peculiar needs of the Lake Superior mining industry has been designed. Practicality, convenience, economy, and sanitation are the ideals that should be incorporated into plans for a modern structure. These ideals were both expanded and modified after an investigation of some of the largest and best plants that manufacture change-house accessories. The plan submitted by the writer (see Pl. XII) is merely a type, and can be decreased, enlarged, or modified in any way that will best meet individual conditions.

The walls of a modern change house are brick or concrete blocks; the roof has tile shingles. The floors are cement throughout, and slope from the walls toward the drainage traps in the center. Both outside entrances have storm inclosures and revolving doors to eliminate direct drafts. The windows are 30 inches square, with hinged bottoms and chain tops, and are easily opened with a window pole. The building is near the shaft and connected with it by a surface runway which is well heated and electrically lighted.

### ROOMS FOR FOREMAN AND SHIFT BOSS.

For convenience, rooms for the mine foreman and shift boss are placed on each side of the front entrance. They are equipped with showers, latrines, sinks, and lockers. A window is inserted in the wall between the passage and the shift boss's room, to be utilized when checking men off and on shifts.

### CHANGE ROOM.

The front passage opens into the change room by a swinging door. Along the walls and down the center of the change room are double rows of lockers. The space allows the placing of over 300 lockers made of open metal screen for easy ventilation and inspection. Five 12 by 12 inch air vents are placed in each side wall of the change room underneath the lockers, to be opened or closed as air conditions demand. Two drying racks are installed on each side, parallel to the double row of lockers.

### WASHING EQUIPMENT.

Large numbers of men can enter quickly and without confusion from the change room into the wash room through the large middle doorway and the smaller door on either side. Twenty-two inclosed showers, 4 feet apart, are placed around the walls of the wash room. Showers of this type are quicker to use and easier to keep in a sanitary condition. Each is equipped with a mixing chamber to control the temperature of the water and air indicator dial. The walls behind the showers are cemented up 7 feet from the floor. Three double wash troughs of white-enameled iron, with a double row of faucets 2 feet apart, run parallel to the change room.

Two laundries, one on each side of the back passage, are entered from the wash room. These are equipped with white enameled-iron laundry tubs. A small closet is partitioned off from the laundry at the left of the passage for the caretaker's supplies.

### LATRINE ROOM.

The latrine room is immediately back of the left laundry room, and is entered through a double swinging door from the back passage. Individual latrines in metal stalls with swinging doors line two walls of the room. The bowls are porcelain, and the seats—of whale-bone-ite or ebonite, to withstand the effect of frequent washings by antiseptics—have open fronts with extended lips. They are flushed automatically when the seat is released. A white-enameled iron urinal trough, which flushes continuously and is divided by stalls, is at one end of the room.

**FIRST-AID ROOM.**

The first-aid room is just across the passage from the latrine room and has both an outside and inside entrance. These doors are 4 feet wide to facilitate carrying stretchers in and out. The first-aid room has a large closet for necessary supplies. The first-aid equipment includes supplies, Army and Navy stretchers, a table, and chairs.

Figures 1 to 9 show plans of typical change houses at certain iron mines in the Lake Superior region:

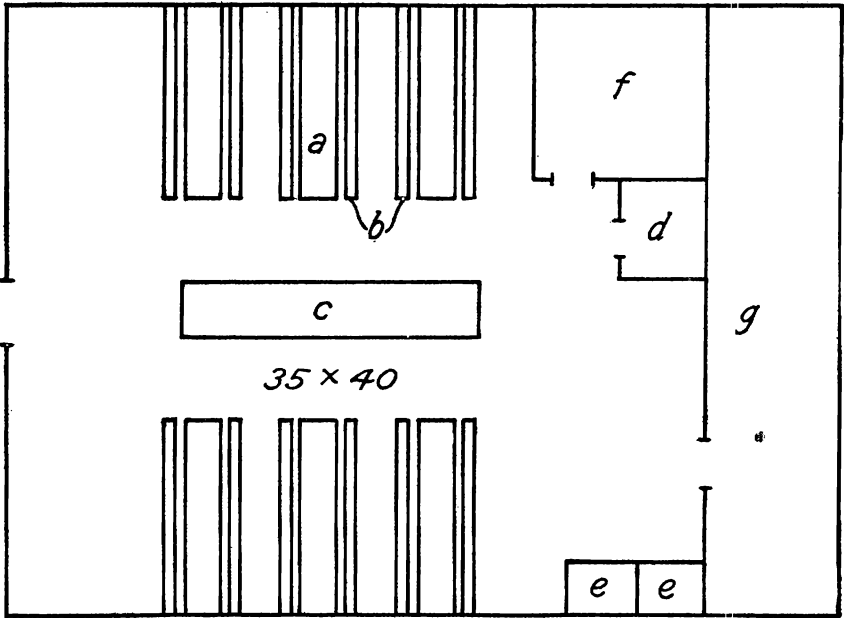


FIGURE 1.—Dryhouse at Virginia, Minn., Mesabi Range: a, Double row of lockers; b, benches; c, wash trough; d, shower room; e, wash tubs; f, captain's room; g, boiler room.

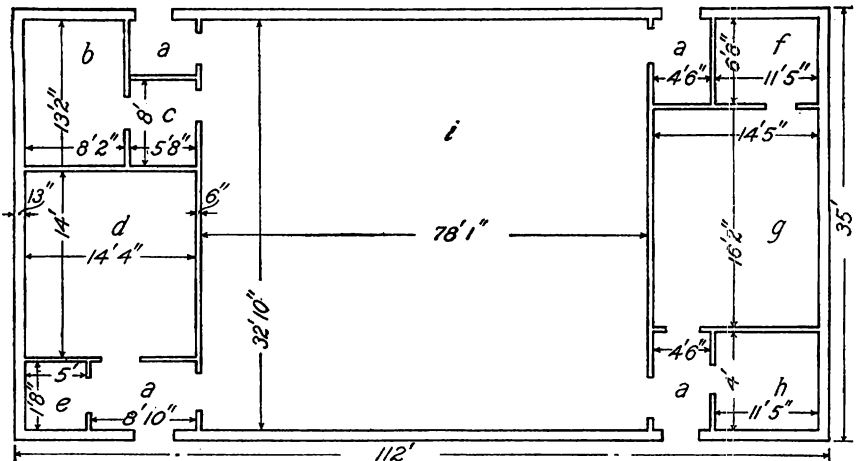


FIGURE 2.—Change house on Vermillion Range: a, Vestibule; b, shower room; c, dressing room; d, main toilet; e, closet; f, toilet; g, captain's room; h, timekeeper's room; i, main change room.

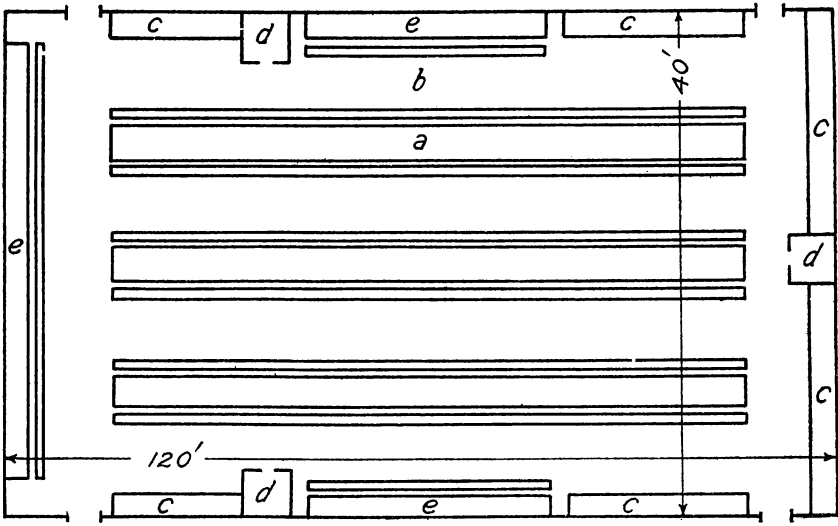


FIGURE 3.—Dryhouse at Ely, Minn., Vermillion Range: a, Double row of lockers; b, benches; c, wash trough; d, shower stalls; e, lockers.

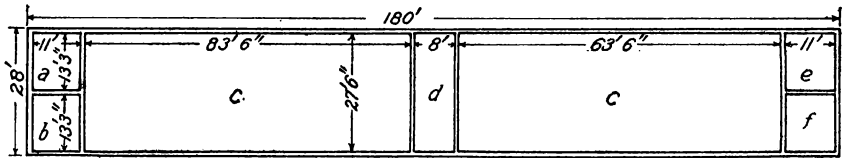


FIGURE 4.—Change house for 400 men, Virginia, Minn., Mesabi Range: a, Captain's room; b, engineer's room; c, main rooms; d, lavatory; e, hospital; f, shift boss.

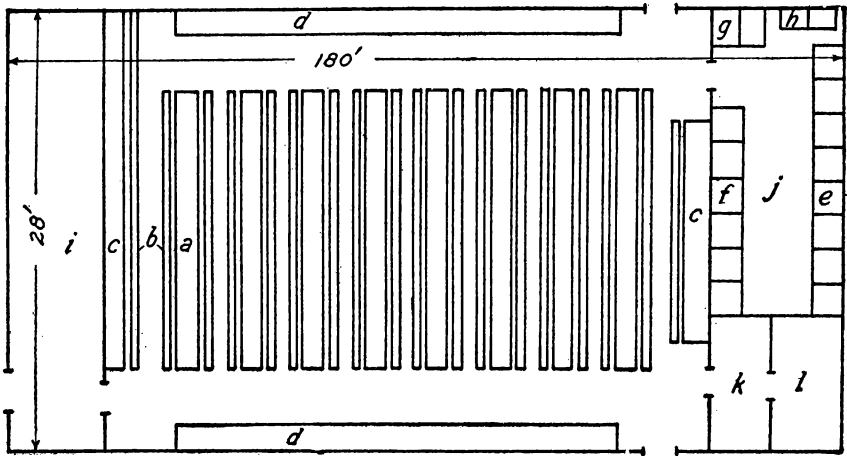


FIGURE 5.—Dryhouse at Hibbing, Minn., Mesabi Range: a, Double row of lockers; b, benches; c, lockers; d, wash trough; e, 8 latrine stalls; f, 6 showers; g, 2 urinals; h, 2 laundry tubs; i, boiler rooms; j, shower and latrine room; k, shift boss's room; l, captain's room.

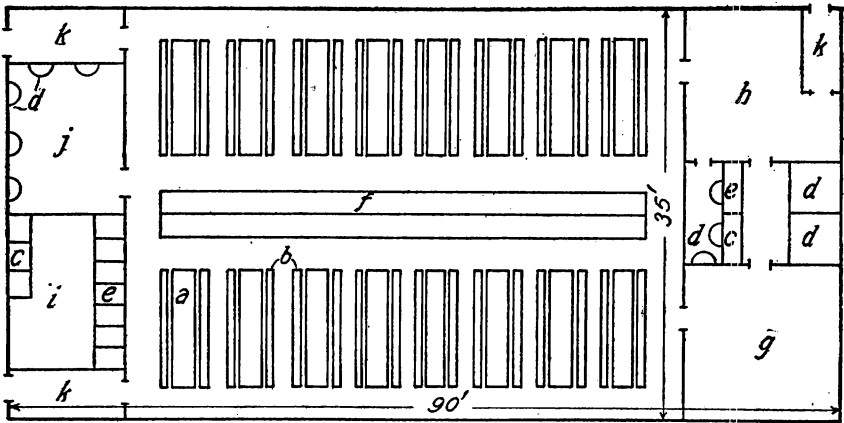


FIGURE 6.—Dryhouse at Kewateen, Minn., Mesabi Range: *a*, Double row of lockers; *b*, benches; *c*, urinals; *d*, showers; *e*, latrines; *f*, double row of sinks; *g*, captain's room; *h*, pipeman's room; *i*, lavrine room; *j*, shower room; *k*, vestibules.

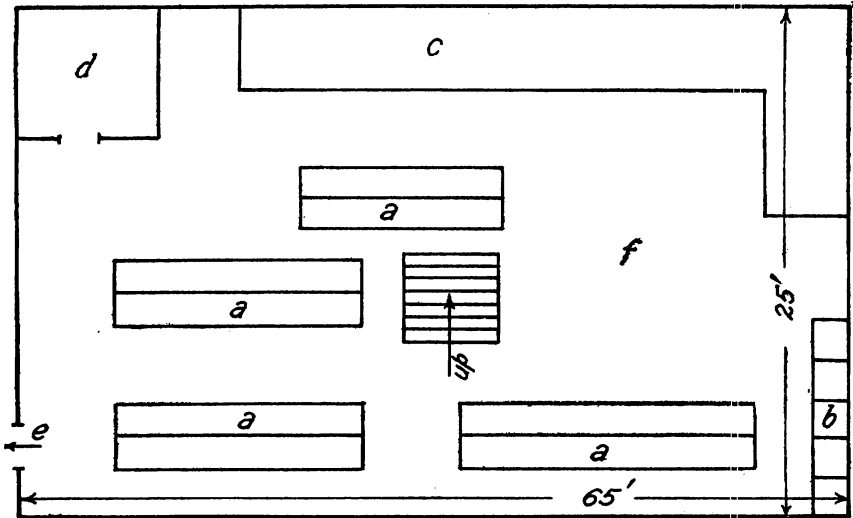


FIGURE 7.—Wash room at Bessemer, Mich., Gogebic Range: *a*, Double row of wash troughs; *b*, 5 laundry tubs; *c*, 13 showers; *d*, captain's room; *e*, entrance to chain room; *f*, main wash room.

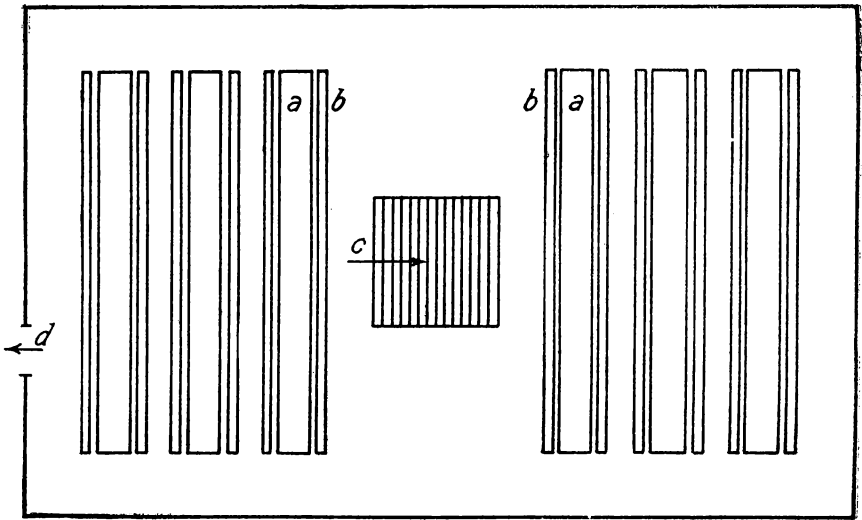


FIGURE 8.—Locker room at Bessemer, Mich., Gogebic Range: *a*, Double row of lockers; *b*, benches; *c*, stairway down to wash room; *d*, entrance to chain room.

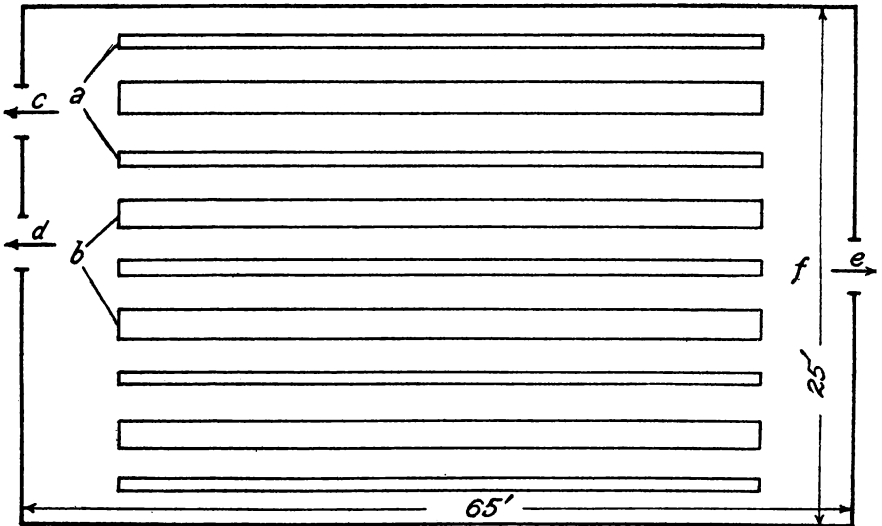


FIGURE 9.—Dryhouse at Bessemer, Mich., Gogebic Range: *a*, 5 wooden chain racks; *b*, steam pipes, 4 in each row; *c*, entrance to wash room; *d*, entrance to locker room; *e*, entrance to dry room; *f*, chain room.

Plates X, B, and XI, A and B, are outside views of three change houses in the Lake Superior region. (Pp. 15 and 16.)



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