Potato Storage

IN ALASKA'S MATANUSKA VALLEY

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POTATO STORAGE IN ALASKA'S MATANUSKA VALLEY

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POTATOES are an important food in Alaska. Matanuska Valley farmers can produce enough to meet the needs of the Anchorage area if the crop can be kept satisfactorily from one year to the next. The Alaska climate, however, makes better-than-average storage and management necessary to insure a continuous supply throughout the year.

After harvest, ventilation must be provided to cool the potatoes. During winter cold spells, stove heat is needed to protect potatoes from cold injury. In late spring and in summer, ventilation, forced-air circulation, and even refrigeration may be required to keep potatoes from sprouting.

Storage capacity and storage of suitable types for holding potatoes from one crop to the next are inadequate at present in the Matanuska Valley. Present storages protect potatoes from light, storm water, and sudden temperature changes, but provisions for close temperature and humidity regulation and for careful handling of potatoes, all essential for long-period storage, are lacking.

The principal types of potato storages used in the Matanuska Valley, with their good and bad features, are illustrated and described in the following pages. Research is being carried on at the Matanuska Experiment Station with the object of lengthening the safe storage period and improving the quality of the stored potatoes. Practical means of refrigerated storage in summer will be studied when facilities become available.

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CUSTOM STORAGE

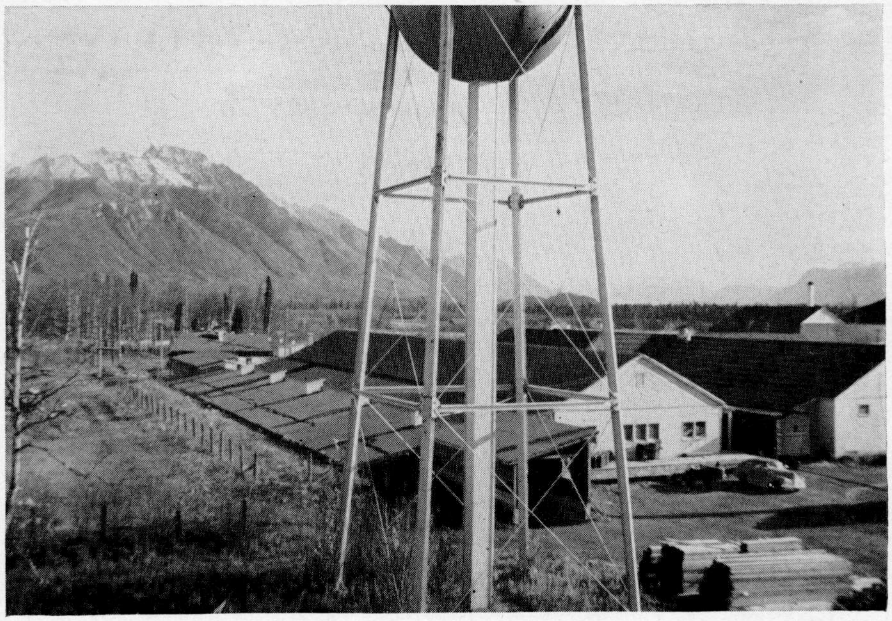

Figure 1.—The Matanuska Valley Farmers Cooperative Association storage at Palmer, Alaska.

About half the potatoes grown in the Matanuska Valley are stored here at the cooperative's warehouse. The potato storage is under the shed roof at the left. Covered entries at the ends protect the ramp and the entrance doors from the weather. A blower intake and five roof outlets provide ventilation, supplemented in the fall by open driveway doors. The location of the warehouse at the side of the railroad track is an advantage for large storages since it permits shipping in any weather.

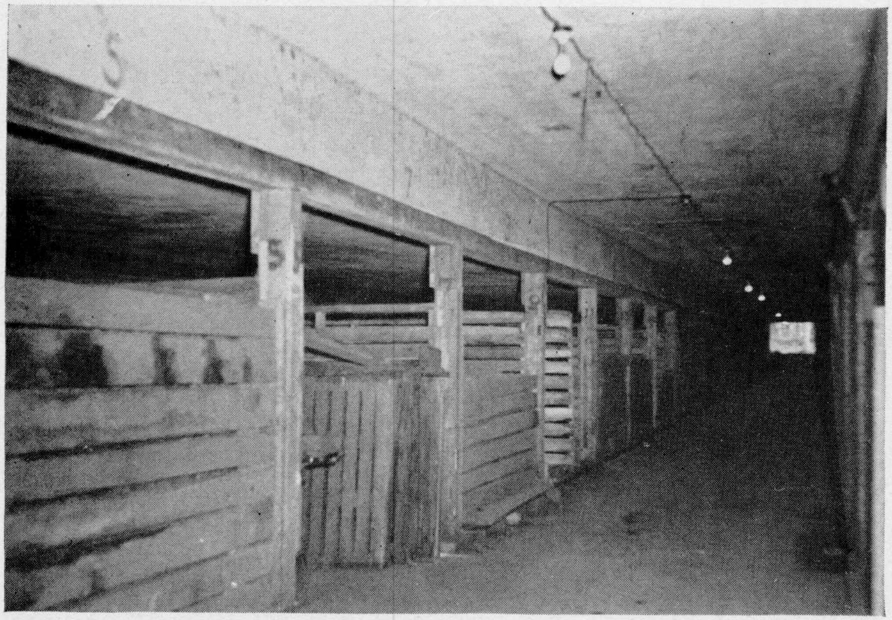

Figure 2.—The central drive and work alley of the cooperative storage.

The concrete floor simplifies storing, grading, and cleaning operations. The ceiling is higher over the drive than over the bins, so that workers can stand on trucks while unloading. The girders over the posts trap air, causing some ceiling condensation and dripping over the front part of the bin. The ceiling lights, shining directly on the bin tops, "green" more potatoes than would lights mounted on the posts below the top of the bins.

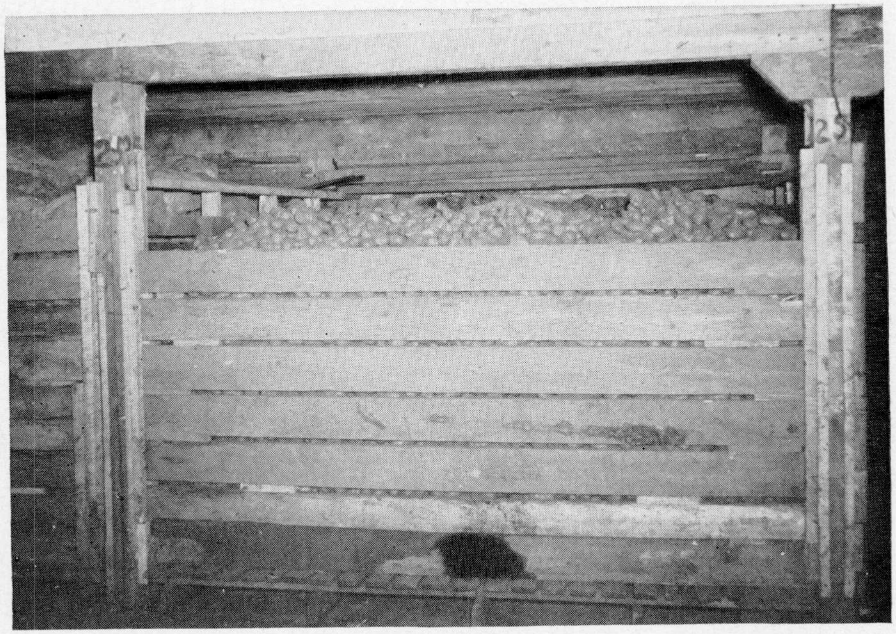

Figure 3.—One of the bins of the cooperative storage.

Air circulation in these bins is by gravity, from the alley under the slatted floor, up through the bin and the double-slatted bin partitions, and past the back wall. This type of air circulation is well suited to warm regions, but in Alaska, adequate cooling, with less shrinkage, can be obtained with shell circulation (fig. 16).

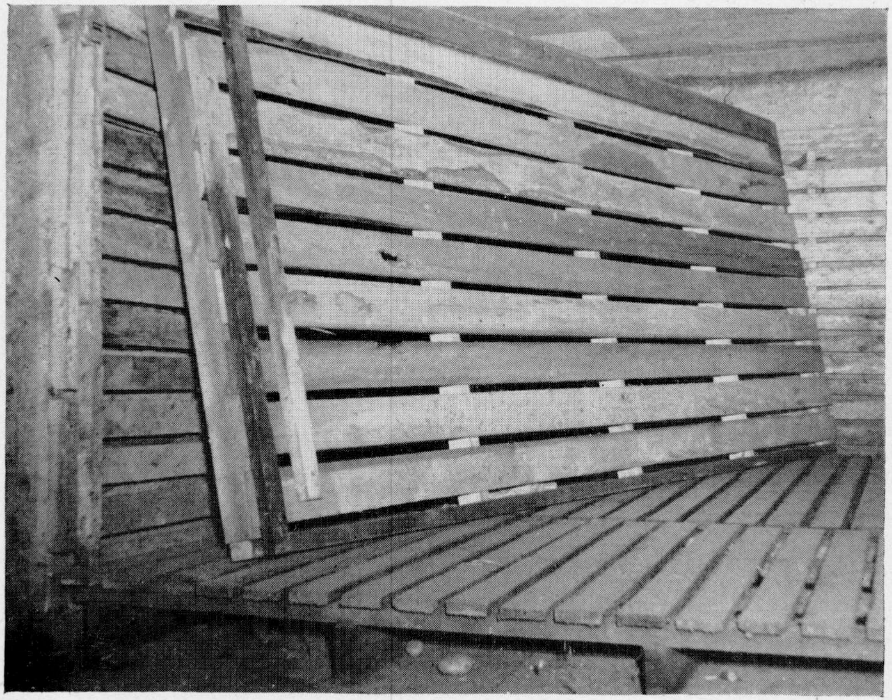

Figure 4.—A bin with movable partition.

In the cooperative storage the posts are spaced to provide 10-ton bins. A few of these bins may be divided lengthwise into two smaller bins by movable partitions. The lengthwise division permits filling or emptying either part without disturbing the other. The floor slats and joists also run lengthwise, which aids air movement between bin and alley and makes shoveling easier. Slatted floors are raised once a year for cleaning, to prevent dirt from clogging the air space below.

STORAGE PIT

Figure 5.—A pit near Palmer, where potatoes from the September harvest were stored until October 10 with no loss due to bad weather.

It would seldom be safe to open a pit between November and May because of the cold, wet weather in the valley. Pitting potatoes, even for short periods, is therefore considered hazardous. Potatoes might be pitted through the winter if covered with 3 feet of straw and 1 foot of earth, well ridged for drainage, but about 1 year in 4 the entire pit of potatoes would probably be lost.

HOME-BASEMENT STORAGE

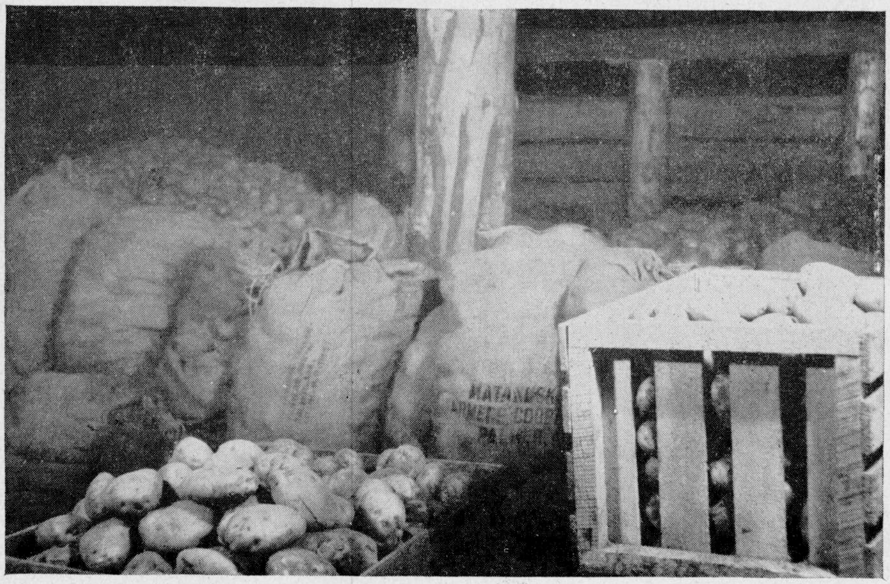

Figure 6.—Potatoes stored in a basement.

Basement storage is practical when the quantity of potatoes does not justify a special storage building. Mechanical injury may be high, however, owing to lack of handling facilities. Here the last of the potatoes were left in the crates and sacks in which they were brought from the field. This reduces labor and mechanical injury to the potatoes through repeated handling. The use of smooth, tight picking boxes is recommended.

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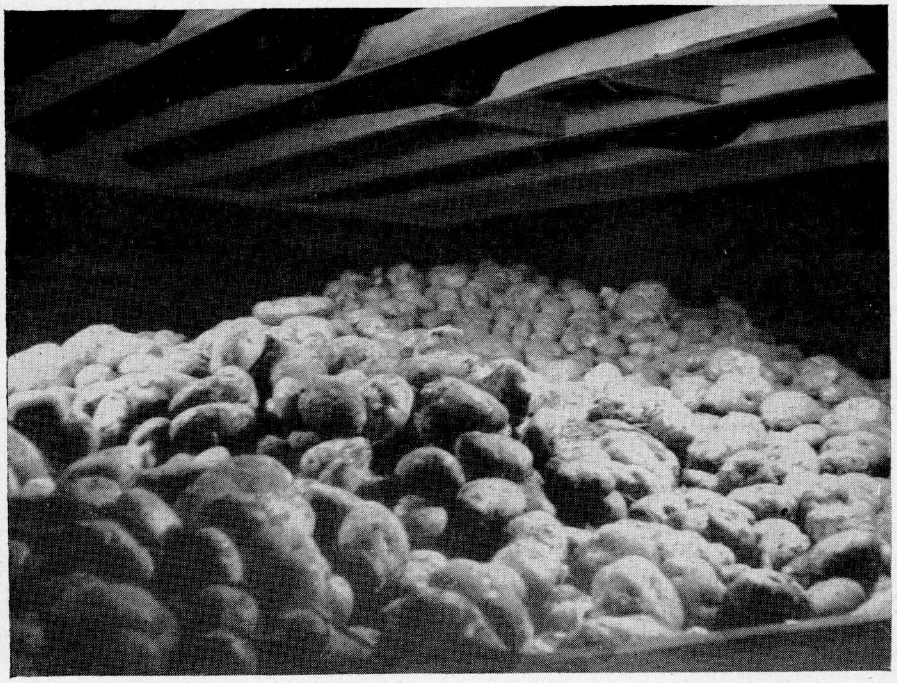

Figure 7.—Potatoes stored in an insulated basement.

Basements are likely to be too warm for storing potatoes for more than 4 or 5 months without excessive shrinking and sprouting. Here the ceiling is insulated to reduce warmth from the heated house above. The blanket type of insulation used here may be sealed below with shiplap or tongue-and-groove boards, plywood, composition board, insulation or plaster board, or plaster on wood, metal, or insulation lath. The ceilings of basement storages are warmer than the potatoes, so ceiling condensation occurs only after uncontrolled ventilation.

EARTH-COVERED STORAGES

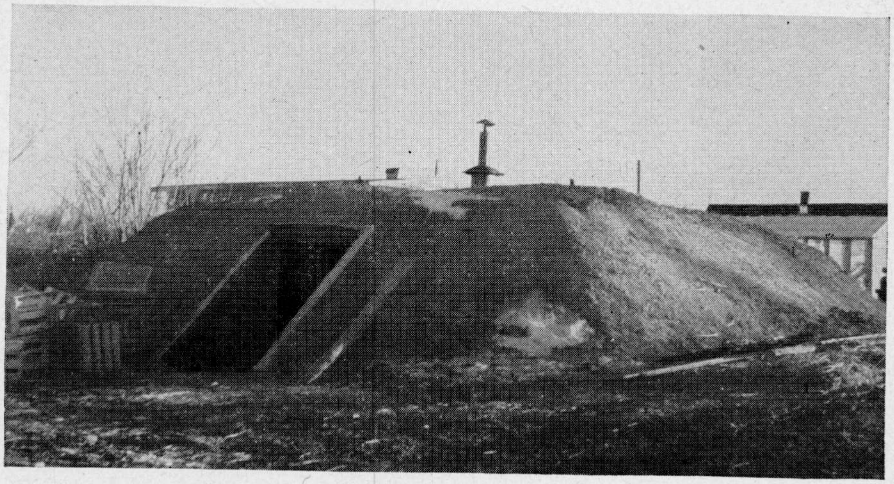

Figure 8.—Earth-covered storage on a level site.

An excavation walled and roofed with logs, then banked and covered with earth is the cheapest storage to build. Here the banking and cover are of peat soil, which has about the same insulation value as sawdust under comparable conditions. (See fig. 13.) The bulkheaded entry permits banking on all sides. It would be better to enclose the entry, although doors for large inclined openings are hard to handle.

Figure 9.—Earth-covered storage on a bank site.

The earth roof ridged in the center provides better roof drainage than the flat roofs in figures 8 and 10. Ridging reduces leakage and maintains insulation values. The exposed end of this storage is protected from the weather by a double log wall with earth fill on the downhill side, similar to the double concrete walls of the storage shown in figure 19. The hillside location permits a level entrance and provides a protected doorway.

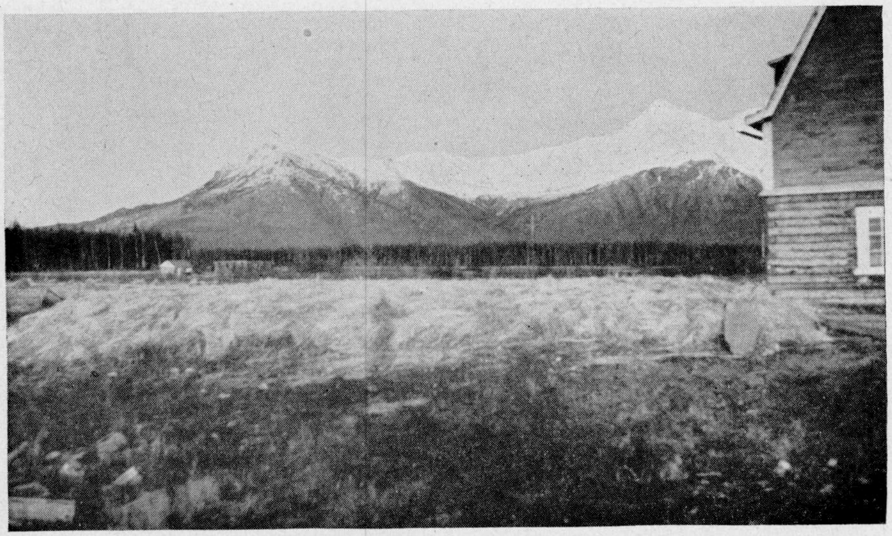

Figure 10.—Earth-and-straw-covered storage.

This is similar to the level earth-covered storage, but the entrance is through the barn basement (fig. 11). To reduce leakage, a uniform thickness of earth cover should be maintained. The earth roof here has been covered with bundled oats to increase the insulation and retard or prevent leakage.

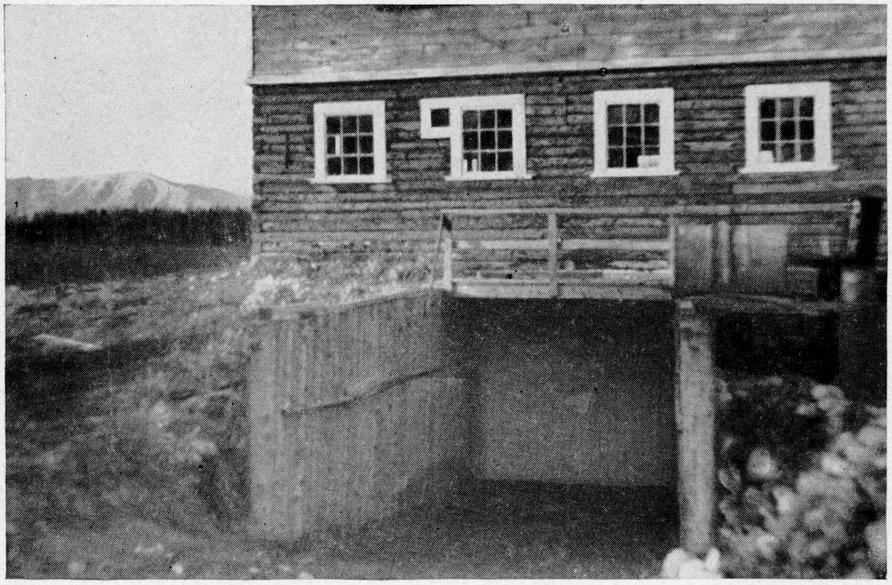

Figure 11.—Entry ramp to the earth-and-straw-covered storage.

The ramp goes down about 4 feet from the ground level to the entrance door. The owner of this storage reports no trouble with the open ramp, but such an entrance is usually unpopular because of the tendency for snow, storm water, and trash to accumulate at the bottom. Ice may form and seal the doors. A covered ramp, such as that shown in figure 1, is preferable.

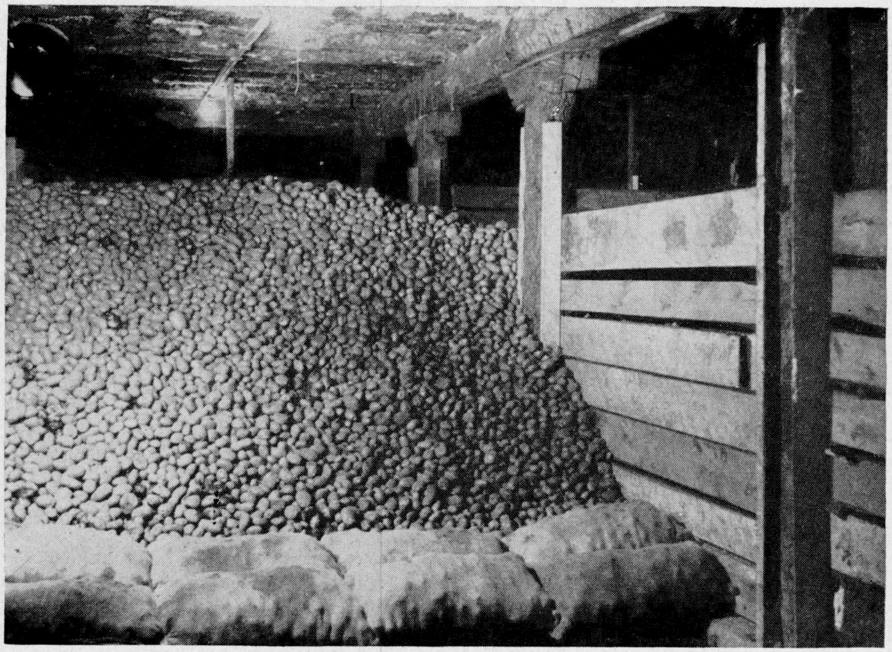

Figure 12.—Log construction in the earth-and-straw-covered storage.

An earth-covered roof may weigh 150 to 200 pounds per square foot. This roof load requires heavy timber framing for adequate support. The post caps shown here are being crushed at the beginning of the second season of use. Untreated spruce used in underground storage ceilings and framing may last only 3 to 5 years. The useful life of such timbers can be greatly increased if they are peeled and seasoned through the spring months, then dipped for 24 hours in a cold solution of 1 part pentachloralphenol and 10 parts fuel oil or kerosene. The logs will absorb about 3 pounds of the liquid per cubic foot.

SAWDUST-COVERED STORAGE

Figure 13.—Storage covered with 24 inches of sawdust over a log ceiling, with ceiling hatches.

Compared with commercial insulation under a weather-tight roof, 24 inches of sawdust, when dry, equals 16 inches of such insulation; when wet, 3 inches; and when wet and then frozen, 1 inch. Peat has about the same comparative value. Since Matanuska weather may not saturate all the sawdust or peat in a season, the value of 24 inches of this material may not drop below that of 4 to 6 inches of dry commercial insulation. Thus sawdust and peat make cheap roof covering even if replaced every 2 or 3 years, though they are not as dependable as an insulated roof protected from the weather (fig. 15).

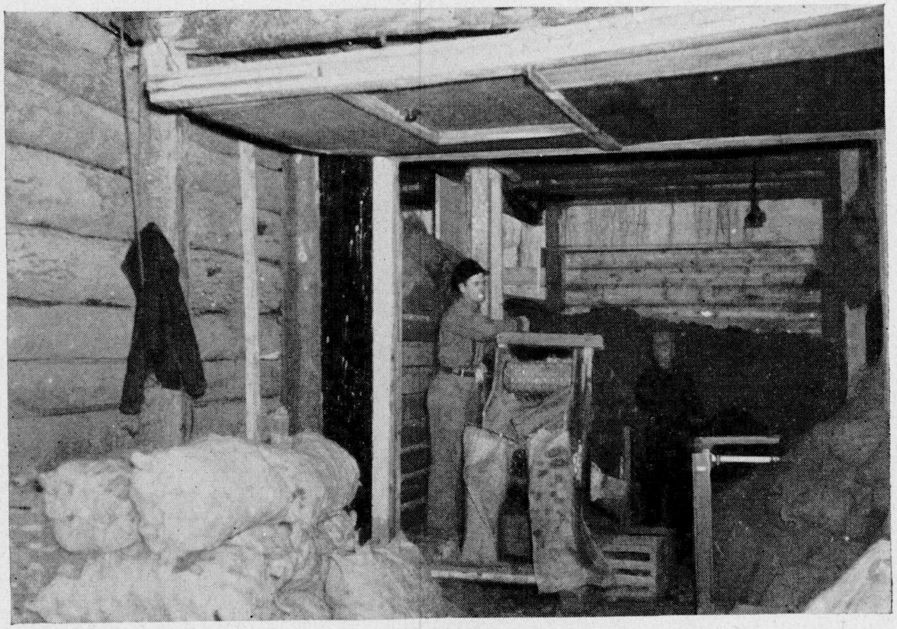

Figure 14.—Entry and work alley of sawdust-covered storage.

The level entry can be used for grading and temporary storage of sacked potatoes to supplement the relatively short work alley of this storage. Central work alleys of farm storages are often used to store the last part of the crop, which must then be the first part to be removed. Here bins are filled through ceiling hatches. This is no longer common practice, because of the danger of injury to the potatoes and the weather hazards of extra roof openings. In cold weather moisture condenses on the under side of the hatch covers, then drips on the potatoes unless the covers are insulated as well as the rest of the ceiling. The overhead door between entry and alley is raised with block and tackle. Insulated doors are usually side-opened because of the difficulty of swinging heavy overhead doors.

FRAME STORAGE WITH SHELL CIRCULATION

Figure 15.—Frame storage with a weatherproof roof.

The roof of this storage protects the 8 to 10 inches of sawdust insulation below it from the weather. Roof and framing take less material than the framing alone in earth-covered storages, because frame roofs are designed to support roof and snow loads of only 30 to 40 pounds per square foot. Frame-roof storages usually have more headroom than underground storages, allowing more space for air circulation above the bins.

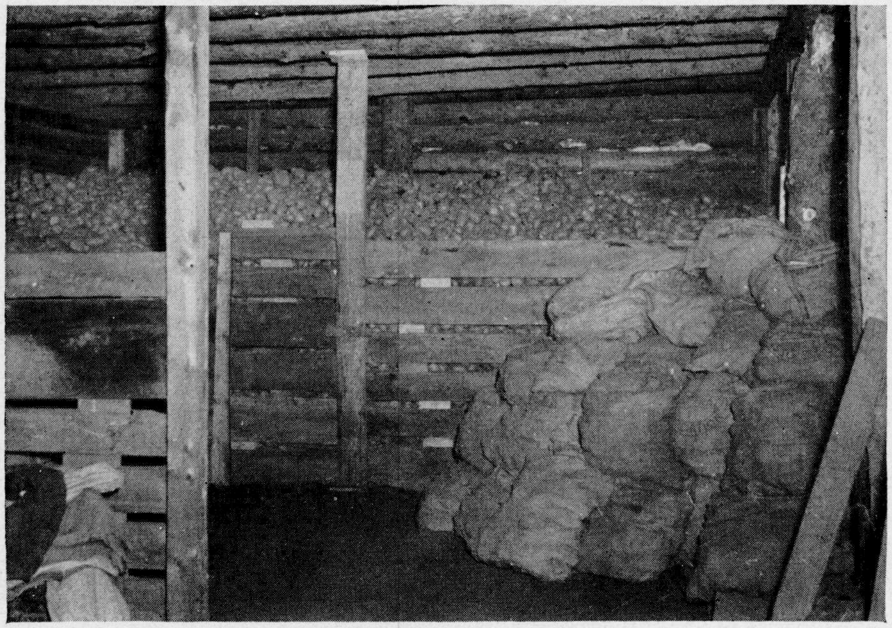

Figure 16.—Shell circulation in the frame storage.

Air for cooling the potatoes is circulated by gravity under the smooth, tight floor and between the outside logs and a smooth, tight wall. The bin front should be tight, like the floor and wall. Air is circulated around instead of through the bin, which results in satisfactory temperature regulation in Matanuska Valley weather. In storage bins with smooth floors and walls potato injury and shrinkage are less than in slatted bins. Shoveling is easier, and cleaning is simpler. In comparative tests, potatoes stored for 5 months lost 3 percent of their weight in tight bins and 6 percent in slatted bins.

ROUND-ROOF STORAGES

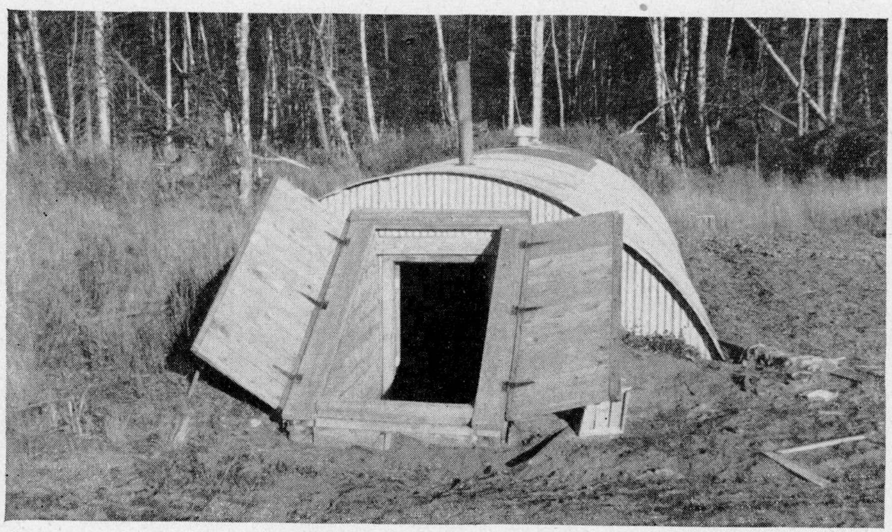

Figure 17.—A Quonset hut storage.

The curved roofs of Quonset and Nissen huts are particularly well adapted to potato storage, and these wartime buildings designed especially for Alaska were usually suitably insulated. The roofs may be set on 4- to 6-foot walls of concrete, planks, or logs. They are suited either to banked or level sites. The high humidity within such storages and the low humidity outside may cause the doors to swell more on the inside than on the outside. Doors that lap on the casing, as shown, are therefore better than those that fit between the jambs.

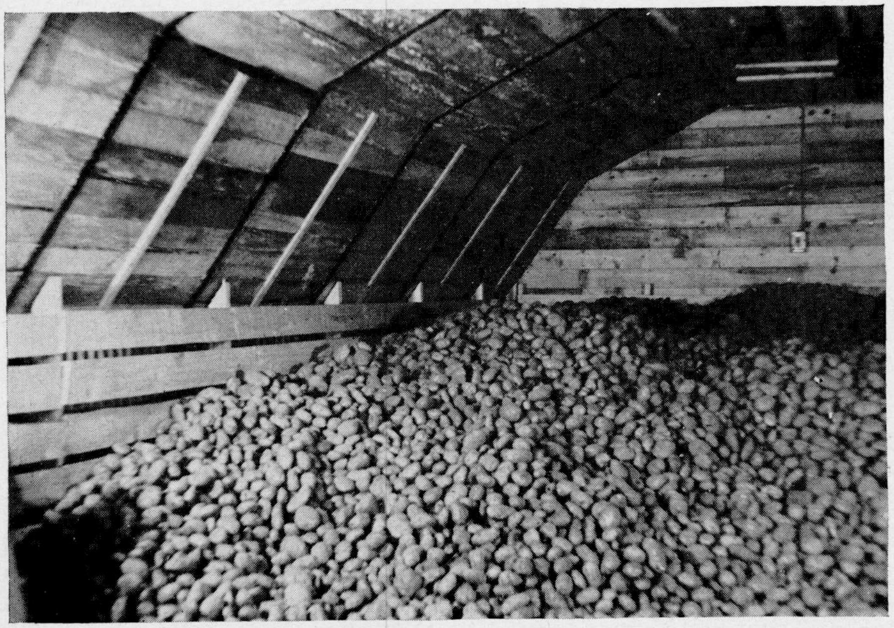

Figure 18.—Interior of round-roofed storage.

Flat interior surfaces of round-roofed storages permit wider choice of lining materials than curved surfaces. Where the moisture content of the interior air is greater than that of the air outside, a highly vapor-resistant interior lining is needed between the potatoes and the insulation. This lining should be more vapor-resistant than those described for insulated home-basement storage (fig. 6). When using matched lumber, plywood, or insulation board, apply two or three coats of asphalt emulsion paint. If sheet metal is used, lap the joints 6 inches, with asphalt-saturated burlap or paper between. The joints between the outside steel sheets should not be made airtight, however, since the insulation must be ventilated. Slatted floors and walls are used in this storage, and the high ceiling provides adequate space for air circulation above the bins.

THE MATANUSKA EXPERIMENT STATION STORAGE

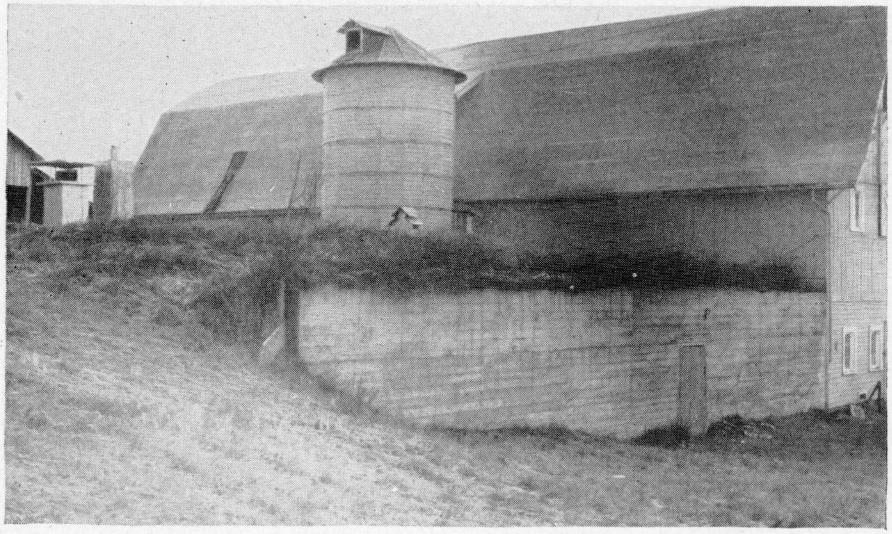

Figure 19.—The earth-covered concrete storage of the Matanuska Experiment Station.

The Experiment Station storage is of reinforced-concrete construction. The exposed side wall is double, with 4 feet of earth between the halves. The reinforced concrete roof is adequate to support the 2- or 3-foot earth cover, though it is much more expensive than a frame roof of equal insulation value. There are entries on both the exposed side and the barn end. The storage is usually filled through the side door and emptied through the barn, which has additional space for grading and temporary storage. The ventilator and chimney, at the left, are shown in more detail in figure 21.

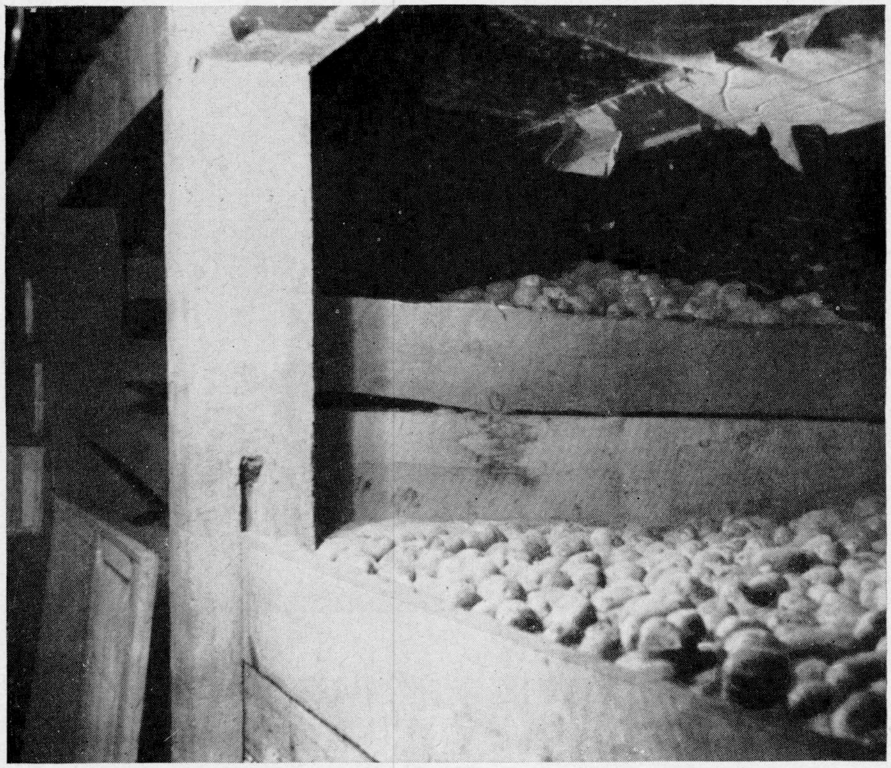

Figure 20.—Interior of Matanuska Experiment Station concrete storage.

In building the station storage, the concrete forms were covered with building paper to facilitate their removal and reuse. Some of the paper is still stuck to the ceiling, but it does no harm there. The posts were made with slots for the bin plank. Though moisture may condense from air trapped at the ceiling behind the girder, to form a concrete ceiling without the girder is not practical. More labor is required and more potatoes are injured and become wet from condensation where bins are filled to within 6 inches of the ceiling, as in the back bin, than where 24 inches of space is left between the potatoes and the ceiling, as in the near bin.

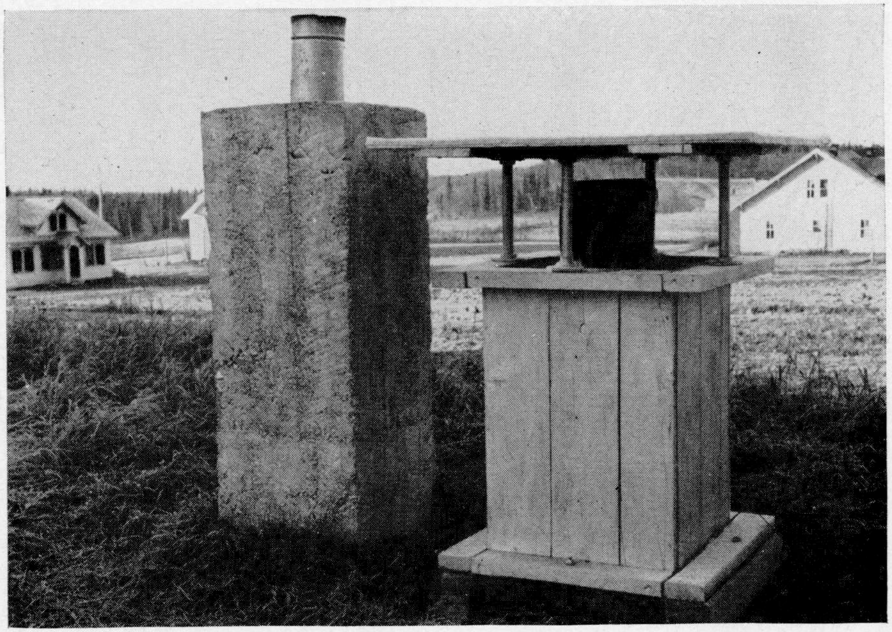

Figure 21.—Storage chimney and ventilator.

The roof ventilator and chimney of the station storage are supported by the reinforced concrete ceiling under the 2- or 3-foot earth cover. Provisions for stove heat, needed during cold snaps and grading operations, should be made in all Alaska storages. This ventilator is divided into two 9- by 18-inch ducts, one for the intake and one for the outlet air. The hinged doors at the top of the ventilator partition, open in this view, may be closed in winter, when ventilation is seldom required. Ventilators are often clogged at the top by inadequate louvres and canopies; here the space between the canopy and the curb is sufficient for full-capacity ventilation.

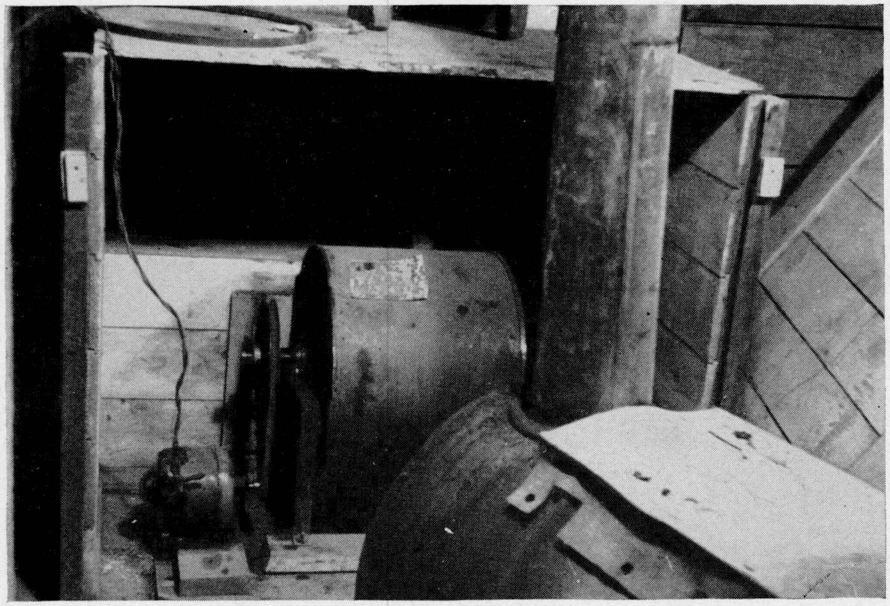

Figure 22.—Stove and fan chamber.

The station storage has stove heat and has thermostatically regulated forced-air circulation and ventiltion. Forced-air circulation keeps storage temperature within a range of 2° to 4° F. (fig. 23), depending on the construction and on the quantity of potatoes in storage. With gravity circulation in large storages, the temperature range is often so great that potatoes may freeze in one part, where the temperature drops below 28°, and may sprout in another part within a few months. The front of the fan chamber was removed for the picture; with it closed, air enters through the ventilator duct at the top (fig. 24) and is forced through ducts under the bins to the right and left. On the left side, which has shell circulation, air goes under the smooth, tight floor and up a tight wall to above the bin, and then back to the ventilator. On the right side, which has through circulation, air goes under the slatted floor, up through the potatoes and the slatted wall to the space above the bin, then back to the ventilator.

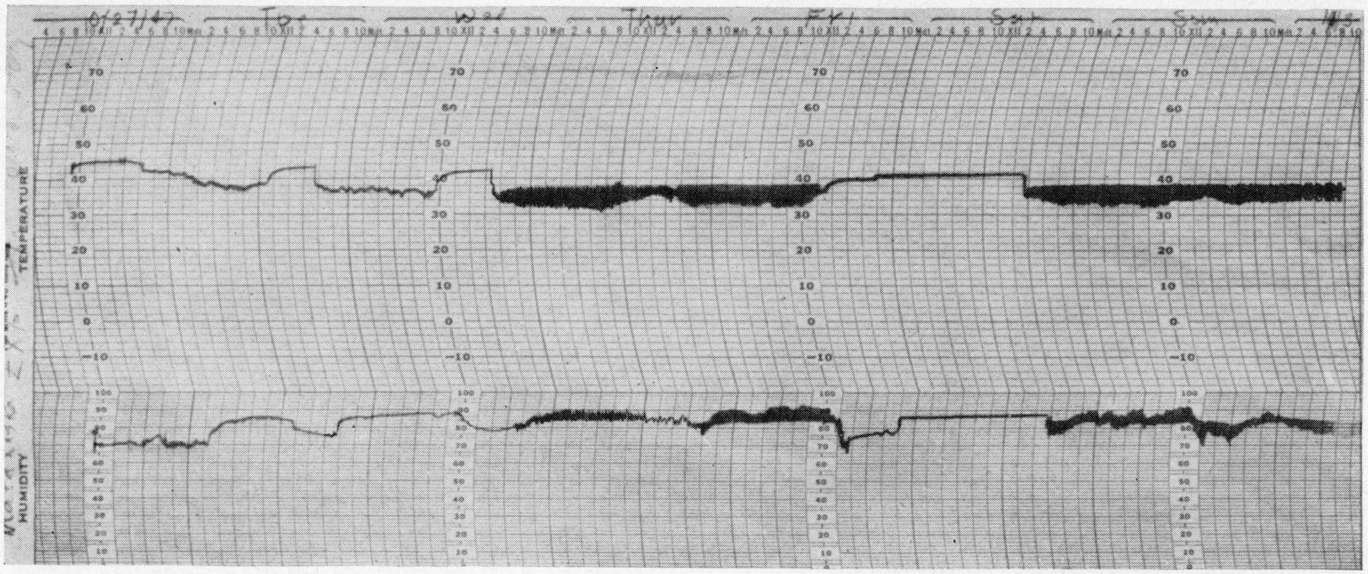

Figure 23.—Chart showing temperature and relative humidity in the Matanuska Experiment Station storage.

Air temperature and relative humidity for the period October 27 to November 3, 1947, are recorded on this chart, which shows the slight variation where forced-air circulation is provided. The broad wavy temperature line (upper line) shows how the regulating system held the storage temperature between 32° and 38° F.

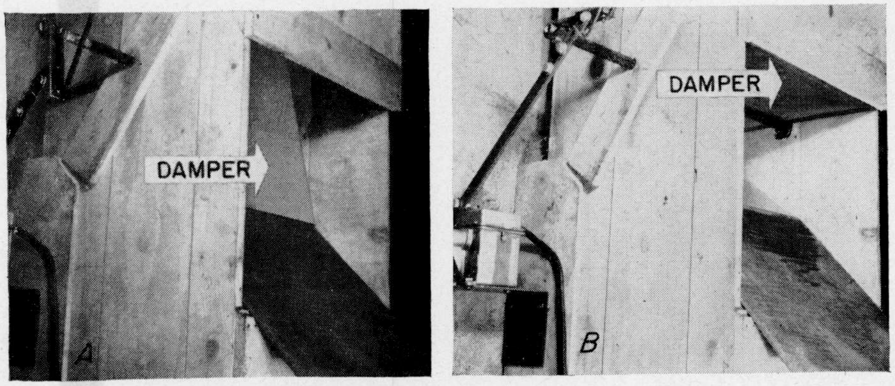

Figure 24.—Motor-and-spring-operated damper for ventilation and recirculation of air in the station storage.

The damper in the ventilator duct, operated by motor and spring, deflects the air to the outlet during ventilation (*A*) or back to the fan chamber during recirculation (*B*). A minimum refrigerator-type thermostat, located in the fan chamber (fig. 22), makes and breaks the damper motor circuit. When the air temperature in the fan chamber is above the set minimum, the thermostat makes the motor turn and hold the damper in the ventilating position.

In ventilation, air is drawn down the back half of the duct (*A*) from outside to the fan chamber, and storage air is deflected upward and out the front half of the duct to the outside air. When the air temperature in the fan chamber is below the set minimum, the thermostat breaks the motor circuit; with the motor off, the spring turns and holds the damper in the recirculation (horizontal) position (*B*).

In recirculation, storage air is drawn under the damper and down into the fan chamber. When the weather is too warm for ventilation and recirculation, the blower is turned off by hand. A maximum thermostat could be used for this purpose, but where the storage is visited daily it is not necessary.

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