Section 5. SUBSISTENCE

5-501. Perishable Subsistence, Chill and Frozen Storage

a. Prevention of deterioration.

(1) General. All chilled and frozen subsistence is highly perishable and subject to rapid deterioration when improperly stored. Storage at temperatures which are too high or too low, under unfavorable conditions of humidity, and in the absence of proper air circulation in unsanitary storerooms will result in rapid spoilage and eventual loss of the product. Most spoilage of chilled and frozen subsistence is caused by micro-organisms, particularly certain species of bacteria and fungi; the contamination spreads rapidly from the decayed items to the surrounding sound subsistence. Therefore, frequent inspection while in storage, followed by sorting and removal of the decayed items or portions thereof, is of basic importance in maintaining the products in top condition and in keeping losses and surveys to a minimum. All shipments should be segregated and marked in such a manner as will assure that the oldest lots are issued first, except when it may become necessary to issue a lot quickly to avoid loss by spoilage or when another lot of the same commodity is in a better condition for continued storage. Old lots of chilled or frozen subsistence should not be allowed to accumulate in storage rooms but should be issued promptly or surveyed if unfit for use. Frozen products will not be accepted in a partially thawed condition, nor will such products be refrozen after having been defrosted.

(2) *Air circulation.*

(a) *General.* Along with proper temperature and humidity, air circulation in a storage room is an important factor in the proper storage of chilled and frozen stored subsistence. This is facilitated by stacking the products on pallets in such a manner, that will provide a 4-inch wall clearance, 2-foot ceiling clearance and sufficient working aisleway.

(b) *Fruits and vegetables.* Containers should be raised off the floor by the use of pallets and individual lots should be stacked so as to permit free circulation of air. The use of a fan or duct system may be desirable in some cases to maintain proper circulation in all parts of the room. The introduction of outside air into cold storage rooms housing fruits and vegetables is not necessary. However, when fresh fruits and vegetables are stored in tight compartment at temperatures of 40° For higher, the concentration of carbon dioxide produced by respiration may reach such a danger point that a match or candle will be extinguished. While this condition is not considered harmful to most products, personnel should not work in such rooms until a supply of fresh air has been introduced.

(c) *Quick-frozen fruits and vegetables.* Quick-frozen fruits and vegetables are highly perishable unless properly stored. Correct handling and proper storage" of such foods are imperative in utilizing frozen foods to the best advantage. Upon delivery, quick-frozen fruits and vegetables should be transferred promptly to a low temperature storage space. Temperature of the load should be checked upon arrival by taking temperature readings of cartons selected from top layers inside of shipping cases. If the temperature of the product is higher than freezer room temperature, shipping cases should be scattered loosely about the room on hand-trucks or upon pallets on the floor with adequate space between individual cases to permit rapid lowering of the product temperature to freezer room temperature. The use of a portable fan to create an air current over the products will hasten temperature equalization. When the temperature of the product has been lowered sufficiently, cases should be stacked compactly. If the product temperature upon delivery is the same as or below temperature of freezer room, the cases should be stacked compactly immediately.

(d) Meat, meat products and poultry. A prime factor in keeping the temperature in all parts of meat storage spaces at the recommended levels is proper circulation of the refrigerated air. Meat items will not be stored on the bare floor; pallets should be placed on the floor to allow free circulation of air under all items stored in the space. Generally, when the recommended temperature in all parts of the refrigerated space is uniform and is maintained within the stacks in the freezer space, the circulation of air may be considered to be adequate.

(e) *Dairy products and eggs.* To keep the air

in a cold storage room fresh, the room must be kept clean and the air must circulate slowly. Ordinarily, adequate air circulation can be provided by the use of pallets on the floor, and by proper stacking of the various lots. Egg cases should not be stacked more than five high to avoid pressure damage.

(3) *Transport and Storage Compatibility of Fresh Fruits and Vegetables.*

(a) General. Although it may be necessary to transport and store various fresh fruits and vegetables together, there, are some products which should be separated whenever possible. Apples, pears, bananas, peaches, plums, cantaloupes, ripe honey dew melons, avocados, tomatoes and other ethylene producing fruits or vegetables should not be stored with lettuce (causes russeting), carrots (become bitter), cucumbers, green peppers, acorn or Hubbard squash (loss of green color). Odors from apples and citrus fruits are readily absorbed by meat, eggs and dairy products. Pears and apples acquire an unpleasant earthy taste and odor when stored with potatoes. Other combinations which should be avoided in storage rooms are apples or pears with celery, cabbage or onions, celery with onions or carrots, green peppers with pineapples and citrus fruit with any of the strongly scented vegetables. Green peppers can taint pineapples if the two are stored or shipped together. Onions, nuts, citrus fruit and potatoes should each be stored separately whenever possible.

(b) Perishable Subsistence Compatibility Groups. For transport and storage fresh fruits and vegetables have been divided into the following compatibility groups:

Group

Temperature: 32° to 34° F (1° to 1° C).
Relative humidity 90 to 95 percent.
Atmosphere: Normally used on berries and cherries only-10 to 20 percent CO_2.
Ice: Never in contact with commodity.

Note. Most members of this group not compatible with *Group 6a or 6b* because ethylene production by Group 1 can be high, snd thus harmful to members of *Group* 6a or *6b.*

Apples (except those varieties listed in *Group 3.*)
Apricots
Berries (except cranberries)
Cherries
Figs (not with apples, danger of odor transfer to figs; also see *Group 6a)*
Grapes (not fumigated with sulfur dioxide (SO_2) in vehicle and no chemicals that release $S0_2$ should be included in packages.
Peaches
Pears
Persimmons
Plums and prunes
Pomegranates
Quinces

Group 2

Temperature: 55° to 65° F (13° to 18° C).
Relative humidity 85 to 95 percent.
Ice: Never in contact with commodity.
Avocados
Bananas
Eggplant (also see Group 5)
Grapefruit [1]
Guava
Limes
Mangos
Muskmelons, other than cantaloupes
Casaba
Crenshaw
Honey Dew
Persian
Olive, fresh
Papayas
Pineapples (not with avocados, danger of avocados' odor absorption)
Tomatoes, green
Tomatoes, pink (also see *Group 4)*
Watermelons (also see *Groups 4* and 5)

Group 3

Temperature: 36" to 41° F (2° to 5° C).
Relative humidity: 90 to 95 percent; cantaloupes about 95 percent.
Ice: In contact only with cantaloupes.
Apples (Grimes Golden and Jonathan (both, certain areas), Yellow Newton (California) and McIntosh.)
cantaloupes
Cranberries
Lemons [1] (use 50 to 55° F for more than a month)
Lychees (also see *Group 4)*
Oranges [1] (Florida or Texas)
Tangerines

Group 4

Temperature: 40° to 45° F (4° to 7° C); beans 38° to 42° F (3° to 6° C).
Relative humidity: About 95 percent.
Ice: Never in contact with commodity.
Beans, snap
Lychees (also see Group 3)
okra
Oranges [1] (California or Arizona)
Peppers, green (not with beans)
Peppers, red (if with green peppers,. temperature adjusted toward top of range)
Squash, summer
Tomatoes, pink (also see *Group* 2)
Watermelons (also see *Groups* 2 and 5)

Group 5

Temperature 50° to 55° F (10° to 13° C); giner not below 55 F.
Relative humidity: 85 to 90 percent.
Ice Never in contact with commodity.
cucumbers
Eggplant (also see *Group* 2)
Ginger (not with eggplant, also see *Group 7*)
Potatoes (late crop)
Pumpkin and Squashes, winter
Watermelon (temperature adjusted for other members of group; also see *Groups* 2 and *4*).

Group 6a

This group, except for figs, grapes and mushrooms, is compatible with *Group 6b*.
Temperature: 32° to 34° F (0° to 1° C).
Relative humidity 95 to 100 percent.
Ice: Never in contact with asparagus, figs, grapes, and mushrooms.
Artichokes
Asparagus
Beeta, red
carrots
Endive and escarole
Figs (also see *Group 1*)
Grapes (not fumigated with sulfur dioxide (SO_2) in vehicle and no chemicals that release SO_2 should be included in packages.
Greens
Leek (not with figs or grapes)
Lettuce
Mushrooms
Parsley
Parsnips
Peas
Rhubarb
Salsify
Spinach
Sweet Corn
Watercress

Group 6b

This group is compatible with *Group 6a*, except for figs, grapes, and mushrooms.
Temperature 32" to 34° F (0° to 1° C).
Relative humidity 95 to 100 percent.
Ice: Contact acceptable for all.
Broccoli
Brussels sprouts
Cabbage
Cauliflower
Celeriac
Celery
Horseradish
Kohlrabi
Onions, green (not with rhubarb, figs, or grapes; probably not with mushrooms or sweet corn).
Radishes
Rutabagas
Turnips

Group 7

Temperature: 55° to 65° F (13° to 18° C).
Relative humidity 85 to 90 percent.
Ice: Never in contact with commodity.
Ginger (also see *Group* 5)
Potatoes, early crop (temperatures adjusted for others)
Sweetpotatoes

Group 8

Temperature: 32° to 34° F (0° to 1° C).
Relative humidity: 65 to 70 percent.
Ice: Never in contact with commodity.
Garlic
onions, dry

[1] Citrus fruits-Biphenyl fungicide may impart off odors to other commodities.

The above information was extracted from Lipton, W. J. and J. M. Harvey, Compatibility of Fruits and Vegetables During Transport in Mixed Loads, US Department of Agriculture, Agricultural Research Service, ARS 51–48 (September, 1972).

(c) *Chill injuries to certain products.* Although the shelf lives of many fruits and vegetables are significantly extended by storage at 32° F, there are some fruits and vegetables which are subject to chill injury when stored at low but nonfreezing temperatures.

Commodity	Approximate lowest safe temperature F°	Character of injury when stored between 32° F and safe temperature
Apples	36–38	Internal browning, brown core, soggy breakdown, soft scald.
Grimes Golden (certain areaa)		
Jonathan (certain areas)		
Yellow Newton (certain areas)		
McIntosh		
Asparagus	36	Chill damage
Avocados	40–55	Grayish-brown discoloration of flesh.
Bananaa, green or ripe	53–56	Dull color when ripened.
Beans (snap)	45	Pitting and russeting.
Cranberries	36	Rubbery texture, red flesh.
Cucumbers	45	Pitting, water-soaked spots, decay.
Eggplants	45	Surface scald, Alternaria rot.
Grapefruit	50	Scald, pitting, watery breakdown.
Lemons	52	Pitting, membranous staining, red blotch.
Limes	4548	Pitting
Mangos	50–55	Grayish scaldlike discoloration of skin, uneven ripening.
Melons		
Cantaloupes	36	Pitting, surface decay
Honey Dew	4$50	Pitting, surface decay, failure to ripen.
Casaba	45-50	Pitting, surface decay, failure to ripen.
Crenshaw and Persian	45–50	Pitting, surface decay, failure to ripen.
Watermelons	40	Pitting, objectionable flavor.
okra	45	Discoloration, water-soaked areas, pitting, decay.
Olives, fresh	45	Internal browning
Oranges, California and Arizona	38	Pitting, brown stain
Papayas	45	Pitting, failure to ripen, off flavor, decay.
Peppers, sweet	45	Sheet pitting, Alternaria rot on pods and calyxes.
Pineapples	45-50	Dull-green when ripened
Potatoes	38	Mahogany browning (Chippewa and Segao), sweetening.
Pumpkins and hardshell squashes	50	Decay, especially Alternsria rot.
Sweetpotatoes	55	Decay, pitting, internal discoloration.
Tomatoes		
Ripe	45–50	Watersoaking and softening, decay.
Mature-green	55	Poor color when ripe; Alternaria rot.

(4) *Recommended average storage period for frozen perishable subsistence.*

(a) Temperature. Storage temperature for all frozen subsistence items shall not exceed 0° F. During shipment the temperature shall not be higher than 10° F. For ice cream the recommended temperature is −10° F and in no case should the temperature exceed 0° F.

(b) Condition. The recommended average storage periods listed for frozen items are based on the assumption that products delivered to the Government were processed and procured in accordance with current specifications and were in good condition at time of delivery. Condition should be the deciding factor when determining if an item is suitable for shipment to an oversea area. Exception to this rule is listed in *f* below. In no case should

a product received in a thawed state be refrozen for storage. Thawing will reduce the average storage life of most frozen subsistence items below the desired economical storage period.

(c) *Packaging.* The nature and condition of the packages are important factors which influence storage life expectancy. Example: packaging materials permeable to water vapor or which are defective will permit dehydration by sublimation (freezer burn) or other defects and materially detract from the quality and appearance of the stored product. A program should be established to reseal or repackage all damaged frozen cargo before it is stored or transshipped.

(*d*) Detection *of deterioration.* Deterioration due to time in storage and/or variations in temperatures can be detected by organoleptic inspection for such defects as dehydration (freezer burn), undue softness or mealy texture, discoloration, off odor, evidence of weeping and evidence of rancidity *and/or* mold.

(e) *Initial quality or grade.* The initial quality of a product at time of receipt by the Government is an important factor which influences storage life expectancy. Initial quality of the product is determined by method of processing and handling, as well as the grade of the ingredients.

(*f*) *Limitations.* Frozen subsistence items with a recommended average storage life of 3 months or less should not be stored for shipment . . . . . to overseas areas. Such items will have exceeded the recommended storage life prior to issue in overseas area. Prior to shipping frozen subsistence items with a recommended average life of less than 6 months, a careful inspection by veterinary personnel should be made with a view toward assuring that there is sufficient storage life remaining to enable routine issue within the overseas command.

(*g*) *Approximate* storage *life.* Storage life is the total elapsed time from date of pack to date of issue for immediate consumption. The approximate storage life given in tables below is the best estimate of expected life, based upon experience gained through subsistence procured and stored in accordance with the applicable specifications and regulations. Specific lots of subsistence maybe expected to show signs of quality loss within ± 20% of the time listed. Therefore, procedures shall be established to provide surveillance from time of receipt until the subsistence is issued and consumed. The frequency of inspection should be established through actual experience with various products, and as prescribed in pertinent military publications.

Table 5-6. Storage life of frozen subsistence at 0° F or below.

	Approx. Storage Life (Months)
Apples	18
Apple juice, concentrated	30
Asparagus	12
Bacon:[2,3]	
prefried	9
slab, type I	5%
slab, type H	12
sliced, type I	1½
sliced, type I, vacuum packed	3
sliced, type II	2%!
sliced, type H, vacuum packed	5½
Canadian	6
Beans	
green	12
lima	14
wax	12

See footnotes at end of table.

Table 5-6-Continued

	Approx. Storage Life (Months)
Beef:[2]	
,, boneless, fabricated	12
carcass, wholesale cuts	12
corned	6
cutlets, boneless (restructured)	9
diced and diced (restructured	9
dried, sliced	12
ground	9
ground patties'	6
liver, whole or portion cut	4
tongue, fresh	4
tongue, cured or smoked, type 1	6
tongue, cured or smoked, type 2	4
Blackberries	18
Blueberries	18
Bologna:[2,3]	
Lebanon	8
50% beef	**3–4**
60% beef	**3–4**
75% beef	6
Boysenberries, dewberries, loganberries, youngberries	18
Bread dough[2]	6
Bread yeast raised (and rolls fresh)[2]	6
Broccoli	14
Brussels sprouts	12
Burritos	6
Butter prints and **patties**[2]	18
Cakes, coffee, layer, loaf, cheese	12
carrots	24
Cauliflower	14
Cervelat:[2,3]	
dry	6
soft **(thuringer)**	**3–4**
Cherries, RTP and dark, sweet, pitted	24
Cheese, pizza blend, shredded	12
Chicken:[2]	
gizzards	6
parts, cut up, ready to cook	8
whole, ready to cook	10
Chitterlings:	
raw	3
precooked	6
Clams, shucked[2]	8
Corn	24
Corn on the cob	9
Crabs	8

See footnotes at end of table.

Table 5-6—Continued

	Approx. Storage Life (Months)
Cranberry juice cocktail	24
Crawfish tail	8
Dates	12
Duck[2]	10
Egg roll	6
Eggs:	
whole (including table grade)[2]	12
whites[2]	12
yokes, sugared or salt added[2]	12
Enchiladas	6
Fish:	
fish inlets, steaks[2]	
fatty (mackerel, salmon)	3
moderately fatty (halibut, perch, rockfish)	6
lean (cod, haddock, flounder)	11-12
fish sticks and portions	1 - 2 less than above
Frankfurters—50 percent pork[2,3]	
type I, carton	½
type I, flexible package	1
type II, carton	2½
type H, flexible package	6
type III, flexible package	12
type HI, can with thaw indicator	15
Grape juice, concentrated	24
Grapefruit juice, concentrated	24
Grapefruit-orange juice, concentrated	24
Grapefruit sections	12
Greens, leafy	14
Hams:[2]	
boneless, cooked	6
Ice cream, sherbets or ices	9
Ice cream, novelties	3
Lamb:[2]	
boneless, fabricated	12
carcass, wholesale cuts	12
cutlets, boneless (restructured)	9
slices, chops	9
telescoped	12
Lard	12
Lemon juice, concentrated	18
Lemonade, concentrated	18
Lime juice, concentrated	18
Lime juice, single strength	18
Lobster tail[2]	8
Lobster, whole[2]	8

See footnotes at end of table.

Table 5–6—Continued

	Approx. Storage Life (Months)
Luncheon loaf[2,3]	3–4
Manicotti	6
Margarine, prints and patties[2]	12
Meal, precooked, (TV dinners, pot pies, etc.)[1,6]	6
Milk fat anhydrous[2]	12
Milk, pasteurized, homogenized[2]	1
Milk, aseptically processed and packaged[2]	1
Milk, whole, concentrated[2,4]	1
Okra	18
Onion rings, french fried and raw	14
Orange juice, concentrated	24
Oysters[2]	8
Pastrami	6
Peaches	18
Peas:	
Mack eye	12
dehydrofrozen	14
green	14
Peas and carrots	14
Pepperoni	6
Peppers	14
Pies, fruit, baked and unbaked:[2]	
cream filled	6
fruit filled	12
Pineapple	12
Pineapple juice, concentrated	24
Pizza	6
Pizza shells[2]	6
Pork*	
barbecued	6
cutlets, boneless (restructured)	8
diced and diced (restructured)	8
hocks, feet	6
hocks, smoked	3
loin, boneless, fabricated	8
slices, chops	8
wholesale cuts	8
Potatoes	
white, french fries, precooked rounds	12
white, hash brown	12
Rabbit?	
ready-to-cook	8
ready-to-cook, cut up	8
Raspberries	18
Rhubarb	24
Ravioli	6

See footnotes at end of table.

Table 5–6—Continued

	Approx. Storage Life (Months)
Salami:[2,3]	
cooked	3–4
dry	5
Sausage:[2,3]	
beef	6
liver	3-4
New England style	4
pork, bulk style	3
pork links:	
type I, carton	¾
type II, carton	2
type III, carton	3
type III, can	9
pork, precooked, Polish, Italian	3–4
pork and beef, precooked	6
Scallops[2]	8
Scrapple	6
Shrimp:[2,7]	
raw, peeled/unpeeled	8
raw, breaded, molded	8
Soups[5]	12
Spinach	14
Spinach, chopped	10
Squash, summer and fall, cooked	24
Strawberries	15
Succotash	12
Sweet goods, yeast raised[2]	2
Tamales	6
Topping, dessert	24
Tortillas, corn or wheat	18
Turkey:[2]	
boneless, cooked	7
boneless, raw	7
whole, ready-to-cook	9
gizzards	6
Veal:[2]	
cutlets, boneless, breaded (restructured)	9
diced, cutlets, breaded	9
boneless, fabricated	12
carcass, wholesale cuts	12
semi-boneless	12
Vegetables, mixed	12
Waffles*	6

[1] Any evidence that meal has been thawed is reason for discarding.

[2] Many of the products listed herein are also storable under chill conditions (above 32° F). See a(4)

[3] These products suffer deteriorative changes as a result of freezing. If frozen storage is necessary, storage times indicated will tend to minimize rancidity development.

[4] Storage life above 0° F is 4 months.

[5] Cream style soups which have broken down during freezing will be satisfactory when heated.

[6] These meals may be used for their intended purpose up to 9 months after date of pack provided surveillance inspections performed at least every 30 days subsequent to the 6 months period result in the product being accepted for consumption.

[7] The quality of frozen shrimp will deteriorate within 30 days if held between 14° "and 18° F.

(5) *Chill storage of perishable subsistence freezing point, storage temperature, relative humidity and storage life.* The following table (table 5-7) is for the guidance of personnel in computing the storage life of subsistence held in chilled storage. Many of the considerations mentioned in paragraph a(1) above are applicable to chilled storage. The storage periods given are applicable only to products processed and procured in accordance with specifications.

(a) Temperature. Chill storage is generally within a temperature range of 32-35° F. For some items, better quality is maintained at temperatures higher or lower than these and are shown as accepted storage temperature. Some items are damaged by slow freezing, for these, the average freezing points are given.

(*b*) *Humidity.* Preferred relative humidities shown in the table are those which best inhibit the gain or loss of moisture in the item. Storage at higher relative humidities may allow water to condense on or be absorbed in the item, while at lower relative humidities, the item may dry and shrink.

(c) *Approximate storage life.* Storage life is the total elapsed time from date of pack to date of issue for immediate consumption. The approximate storage life given in table 5-7 is the best estimate of expected life based upon experience for subsistence procured and stored in accordance with applicable specifications and regulations. Specific lots of subsistence may be expected to show signs of major quality loss within ±20% of the time listed. Therefore, procedures shall be established to provide surveillance from time of receipt until the subsistence is issued and consumed. The frequency of inspection should be established through actual experience with various products, and as prescribed in pertinent military publications.

Table 5-7. Chill storage of perishable subsistence.

Item	Average Freezing Point	Accepted storage Temperature	Preferred Relative Humidity %	Approximate Storage Life (Days)
Artichokes, globe	30	32	95	14
Artichokes, Jerusalem	23	32	30-100	150
Apples[g]	29	32	90	See Note 2
Red delicious, Washington	30	32	90	See Note 2
Apricots[3]	30	32	90	7–21
Asparagus, fresh[3,19]	31	32	95	10
to prevent chill damage during extended storage		36	95	14-21
Avocados:				
cold tolerant[3] Mexican & Guatemalan var. usually rough skinned	31	40-45	35-90	14-28
cold intolerant West Indian var. usually smooth skinned (summer months)	31	55	85–90	14

See footnotes at end of table

Table 5-7. Chill storage of perishable subsistence—Continued

Item	Avenge Freezing Point	Accepted Storage	Preferred Relative Humidity %	Approximate Storage Life (Days)
Bacon[g]				
slab, type I	.....	32-35	85-90	42
slab, type II	.....	32-35	65-90	70
sliced, type I	.....	32–35	85–90	14
sliced, type 1, vacuum packed	.....	32–35	65-90	21
sliced, type H	.....	32–35	85-90	21
sliced, type 11, vacuum packed	.....	32–35	35-90	35
Banana;				
green	31	56–58	90–95	7–lo
ripe	.....	56–58	85	2–4
Beans:				
green or waxed	31	4S50	95	7-1o
lima, unshelled, shelled	31	32	95	7
Beef:				
carcass and wholesale cute	.....	32-36	85-90	10–14
corned	.....	32-35	65-90	9-11
dried, sliced	.....	32–35	.....	28–42
ground	.....	32-35	85–90	4
tongue, fresh	.....	32-35	85-90	35–42
tongue, smoked	.....	32–35	85–90	3542
Beets, bunch	31	32	95	10–14
Beets, topped[11]	30	32	95-1oo	20–180
Berries, black, rasp, **logan,** boysen, young, dew	31	32	95	2-3
Berries, straw	31	32	90-95	5-7
Blueberries	30	32	90-95	14
Bologna:[9]				
Lebanon	.....	32–35	85–90	60
50 percent beef	.....	32–35	65-90	12
Broccoli[8]	31	32	95	10-14
Brussel sprouta	31	32	95	21-35
Butter, prints and patties	.....	32-35	Less than 55	30
Cabbage:				
red	31.7	32	95-1oo	21-42
summer types	31	32	95-1oo	2142
winter types	31	32	95–100	90-120
Chinese, table ready shredded	31	33-35	.....	7-1o
cantaloupe:				
hard **ripe**[6]	30	36	90-95	15
fullslip	30	32–35	90-95	5-14
Carrots:[11,20]				
table ready, sliced	30	3235	.....	10-14
mature, topped	30	32	98–100	50–270
immature, **topped**	31	32	96-1oo	28-42
bunch	30	32	95–98	10–14
Casaba melon	30	45-50	90	28–42
Catsup:				
boat, envelopes"	.....	50	30-90	160
cup, foil pouch"	.....	50	.....	365
Cauliflower>'	31	32	95	14–28
Celeriac	30	32	95–100	90-120

See footnotes at end of table

Table 5-7. Chill storage of perishable subsistence—Continued

Item	Average Freezing Point	Accepted storage Temperature	Preferred Relative Humidity %	Approximate Storage Life (Days)
Celery:				
northern grown[1]	31	32	95	30-60
California or Florida[21]	31	32	95	35-42
Cervelat:[9]				
dry[10]		32-35	75–80	45
soft (thuringer)		32-35	85-90	14
Cherries, sweet[3,18]	29	30-31	90-95	14-21
Chicory	30	32–34	85–95	10-30
Chives, potted	30	35–45	90-98	14
Cheese:				
blue veined, natural		32-35	70-75	180
cheddar, natural	25	30-34	65–70	540
cottage	30	32-35		14
cream (hot pack process)		32-35	70–75	120
mozzarella, natural		35	70-75	30
process American, piemento or Swiss loaf	25	32-35	65-70	540
sliced		32-35	65-70	360
parrnesan, natural		32-35	70-75	360
pizza blend		35	70-75	180
provolone, natural		35	70-75	360
Romano, natural		32-35	70-75	360
Swiss, natural	25	32-35	70-75	360
Chocolate drink	29	32–35		7
Clams, shucked		3'2-35		4
Cookie dough		32		90
Corn on the cob, top-iced'	31	32	95	4-8
Cranberry:				
fresh	30	36-40	90-95	60-120
sauce, cup"		50		180
Cream:				
half and half, including filled	31	32-35		7
sour, cultured	31	32-35		14
table, including filled	31	32-85		10
whipping	31	32-35		10
whipping, ultra-pasteurized (UP)[23]	31	35–45		84
Crenshaw melon	30	45-50	90-95	14
Cucumbers	31	50-55	90-95	10-14
Currants	30	31-32	90-95	10-14
DaSheens, (taro root)	30	45–47	98-1oo	60-120
Dates, pitted, cured:				
cane sugar types	1	32	70–75	180
invert sugar types	5	32	76	180
Eggnog	28	32-35		14
Eggnog (UP[23])	28	32-35		84
Eggs, shelled				
fresh	27	29-31	80-85	150-180
oil processed	27	29–31	70-80	150–180
Egg plant[3,6]	31	45-50	90–95	7-1o

See footnotes at end of table

Table 5-7 Chill storage of perishable subsistence—Continued

Item	Average Freezing Point	Accepted Storage Temperature	Preferred Relative Humidity %	Approximate Storage Life (Days)
Elderberry	30	31-32	90-95	60-120
Fennel	30	32	90–98	60-120
Figs, fresh	27	32	85–90	7–lo
Frankfurters, 50 percent beef, 50 percent pork:[9]				
type I, carton	.....	32-35	85-90	10
type I, flexible package	.....	32-35	85-90	21
type II, carton	.....	32–35	85–90	35
type II, flexible package	.....	32-35	85-90	35
French "dressing, "cup, boat or envelope	31	50	80–90	80–90
Fruitcake, fresh	.....	40	50-60	300
Fruits, dried	22-26	3240	50-60	80--360
Garlic, dry	30	32	65-70	8(L21O
Ginger, rhizomes	.....	55	65	180
Gooseberries	30	31-32	90-95	14-28
Grapefruit[16,17]	30	50	85–90	28–42
Grapefruit, Florida September tc February harvest[16,17] All Calif. & Arizona	30	58–60	85–90	28
Grapefruit, sections	.....	35-45	.....	540
Grapes:				
American, types'	30	32	85	21-56
European, types	28	30	90-95	60-180
Greens:				
endives, escarole"	31.9	32	95	14-21
collards, kale, rape, beet, mustard turnip,[5] chicory	31	32	95	10-14
Ham:[9]				
cured, canned	.....	32–35	60-65	270
boneless, cooked	.....	32-35	85-90	28
smoked[10]	.....	3%35	85–90	28
Honeyball, melon	31	45–90	90-95	21-28
Honeydew, melon	30	45–50	90-95	21-28
Horseradish, prepared	30	32	.....	90
Horseradish, root	29	30–32	35-1oo	100-360
Huckleberries	29	32	80–85	7-1o
Jams, jellies, preserves:				
boat, envelope"	.....	50	80-90	180
cup, foil pouch"	.....	50	.....	365
Kohlrabi[3]	30	32	95	14–28
Kumquats	29	33-35	85–90	60-120
Lamb, carcass, wholesale cuts'	.....	32-35	85	7-1o
Lard, service style	.....	45	90-95	120-240
Leeka	31	32	95	30-90
Lettuce, iceberg, individual: wrapped in polystyrene film[12]	32	3244	95–100	14-21
Lettuce, leaf, romaine	32	3244	95–100	5–8
Lettuce, table ready, whole o chopped	32	32-34	.....	5–7
Lobster, live in water	.....	33–50	.....	7
Lemons[fi]	30	55	85–90	30-90

See footnotes at end of table

Table 5–7 Chill storage of perishable subsistence—Continued

Item	Average Freezing Point	Accepted storage Temperature	Preferred Relative Humidity %	Approximate Storage Life (Days)
Lemon juice, reconstituted, ind. serving, pkg.	30	50	.....	120
Limes	29	48–50	85–90	42-56
Luncheon, loaf	.....	32-35	85–90	14
Mangoes	30	55	85–90	14-21
Margarine, prints and patties[1]	.....	32-35	40–70	60-W
Meal, combat, individual	.....	32	50	7 years
Milk:				
buttermilk	3 1	32-35	.....	14
chocolate flavored	29	32-36	.....	7
chocolate flavored (UP)[23]	29	35–45	.....	84
concentrated	29	32-35	.....	6
fluid, pasteurized, all types	30	32-35	.....	7
fluid, homogenized (UP)[23]	31	35–45	.....	34
ice, mix, fresh, liquid	31	3X35	.....	10
shake, mix, fresh, liquid	31	3X35	.....	10
Mushrooms	30	3%34	90	3–4
Mustard:				
boat, envelope"	30	50	80–90	90
cup, foil pouch[17]	30	50	.....	270
Nectarines	30	31-32	90	14–28
okra	29	45–50	90–95	7-1o
Olives	29	45–50	85-90	28–42
Onions: 13				
Bermuda, dry	31	32	65-70	30–60
globe, dry	30	32	65–70	130-240
green, top-iced	30.4	32	95	21–26
Spanish	31	32	6s70	90-1s0
peeled or green, table ready	31	32-35	65-70	5–7
oranges:				
California[22] Arizona	30	4044	65-90	28–42
Florida, Texas	30	32	85-90	56–84
Temple, Tangelos	30	36-40	90–95	14-23
sections		35–45	.....	540
Orange juice	30	32	.....	21
Oysters, shucked in ice	.....	32–35	.....	4
Papaya	30	55–60	8690	7-21
Parsley	30	32	95	30-60
Parsnips	30	32	98–100	60-180
Peaches*	30	31-32	90	14–28
Peanut butter:				
boat, envelope	.....	50	80-90	180
cup, foil pounch	.....	so	80–90	366
Pears[3,7,8]	29	29–31	90–95	See note 8
Peas, unshelled	31	32	95	7-14
Peppers, sweet	31	45-50	90–95	14-21
Peppers, dry, chili	.....	32–50	6(L7O	130
Pepperoni, dry[9]	.....	32–35	75–80	23
Persian melons	31	45–50	90–95	14
Persimmons	28	30	90	90-120
Pies				
fruit, fresh	.....	35	80–85	3
fried, fresh	.....	35	80–90	6

See footnotes at end of table

Table 5-7. Chill **storage** of perishable **subsistence—Continued**

	Average *Freezing* Point	Accepted Storage Temperature	Referred Relative Humidity %	Approximate Storage Life (Days)
Pineapple:				
mature, green[6]	*30*	50–55	*85-90*	21-28
ripe[3]	30	45	*85-90*	14
Plums	30	32	90-95	21-28
Pomegranates	27	32	90	14-28
Pork, wholesale cuts[9]		32-35	85-90	5
Poultry, all forms	27	30	M-1OO	5
Potatoes, sweet (cured at 85° F)[3,6]	'30	55–60	8s90	.2CL21O
Potatoes, white:[14]				
early crop, uncured	31	50	90	60
early crop, cured before storage	31	40	90	120–150
late crop	31	40	90	.50-240
peeled, table ready	31	35	95	5-9
Potatoes, white, irradiated, LPPD	30	4045	85-90	380
Prunes, Italian	30	32	90-95	14-21
Pumpkins	31	50-55	70–75	60–90
Quinces	28	31-32	90	00-90
Radishes:				
spring, topped, poly bag	31	32	95	21-28
spring, table ready	31	32	95	10-12
winter, topped	31	32	)5–100	60–120
Rhubarb	31	32	95	M-28
Rolls, brown and serve		32	80–85	21
Rutabagas, topped	30	32	38-1oo	120-180
Salad dressing, cup, boat, envelope?'	31	50	80-90	90
Salmon steaks		32–35	85-90	28
Salami:[9,10]				
dry		32.s5	75-80	80
cooked		32–35	85-90	14
Salsify	30	32	)8–100	60-120
Sausage:[9]				
liver		32–35	8s90	14
New England style		32–35	85–90	10
pork links:				
type I		32–35	85-90	14
t y p e " 111I..I.....a..n..d		32–35	8s90	21
pork bulk		32-35	85–90	14
Scallops		32–35		4
Shallots	31.7	32	95	21-28
Shortening compound, can, carton, cube		32-35	*ess than 55*	1800
Shrimp, unpeeled, in ice		32–35		14
Syrup, imitation maple, cup, boat or envelope[17]		50	80–90	385
Spinach[3]	31.5	32	95	10–14
Squash, fall and winter, Hubbard	30	50–55	70-75	180
acorn	30.5	50	70–75	35–56
butternut	30	50	50	60–90
summer	31	32-40	90	4-5
to prevent chill damage during extended storage		45–50	30	10–14
Swiss chard[3]	31	32	95	10–14

See footnotes at end of table

Table 5–7. Chill storage of perishable subsistence—Continued

Item	Average Freezing Point	Accepted Storage Temperature	Preferred Relative Humidity %	Approximate Storage Life (Days)
Tangerines	30	32	85–90	14–28
Tomatoes:				
mature, green[3,6]	31	55–70	85–90	7-21
pink	31	50–55	85-90	3–5
firm, ripe	31	45–50	85-90	4-7
full color development	31	32-35	85–98	21 after development of full color
Trees, Christmas, cut	.....	22-32	85	60
Turnips	30	32	95	120-150
Veal and calf sides, wholesale cuts'	.....	32-35	85	6
Watercress	31	32-35	90-95	7
Watermelon[8]	31	40-50	85-90	14-21
Yeast, bakers:				
active, dry	.....	30-39	60-70	180-360
compressed cake	.....	30-32	80-90	30-90
Yogurt, plain or fruit flavored	30	30–35	.....	30

Table 5-7. Footnotes

[1] Soybean oil margarine is considered by some authorities to be less stable than cottonseed oil margarine.

[2] The length of time apples can be held successfully in cold storage at 32° F, unless otherwise specified, will vary with the variety, with the district where grown, as well as with their condition when harvested. Controlled atmosphere can extend storage life an additional 2 to 4 months,

Variety	Storage period (month)		Variety	Storage period (months)	
	Nod	M-urn		Normal	Maximum
Baldwin	4t05	7	Northern Spy	4t05	8
Cortland	3t04	5	Rhode Island		
Delicious	4t05	8*	Greening	3t04	6
Golden Delicious	4 to 6	8*	Rome Beauty	4t05	7
Grsvenstein	oto2	3	Stsymsn Winesap	4t05	6
Grimes Golden (some areas 34–36° F)	2t03	4	Wealthy	oto2	3
			WineSap	5-7	8
			Yellow Newton (Calif. 38–48° F)	5t06	8
Jonathan (some areas 35–36° F)	2t03	4	York Imperial	4t05	6
McIntosh (some areaa 38" F)	2t04	5			

*Stored in polyethylene bag liners (unsealed)

[3] Commodities not recommended for export, but which are suitable for immediate use by shore activities and by ships in port or shortly after sailing.

[4] Not recommended for export since the European type of grape from California with better keeping quality is available during the same period.

Table 5-7. **Footnotes—Continued**

[5] Foothill grown lemons stored better than coastal grown lemons, especially late picked; at Receiving Markets only "Strong" lots of lemons should be stored and frequently inspected.

[6] Damage will result if item is stored at lower temperature than indicated.

[7] For best ripening, pears should be held at about 65° F. for 2 to 3 days prior to serving.

[8] Pears-Length of safe storage for certain varieties of pairs.

Storage of Pear varieties at 30 to 31* F.	Length of storage Period (months)
Stored immediately after harvest at 30° to 31" F.	
Anjou	4 to 6*
Bartlett, Cornice, Hardy and Kieffer	2 to 3
Bose and Seckel	3 to 4*
Packam	5 t0 6
Winter Nelis	6 t0 7

* The storage life of Anjou, Bartlett, Bose and Cornice pears may be extended for an additional 1-2 months by packaging in pol yethelene linera.

[9] Carcasses *and cuts:* Quarters, carcasses, and cuts of beef, lamb and veal should be hung or placed on racks when in chill space. If such items are in a solid frozen condition when received, stow compactly as possible in the freezer space. Frozen boneless beef should be stacked compactly. Veal carcasses or cuts, particularly of the lighter weights and lower grades, are subject to rapid deterioration. Holding time of such items in the chill space should be held to a minimum. Fresh chilled pork cuts should be treated as highly perishable.

Variety meats and sausage: Such items are highly perishable. Hold storage time to a minimum.

Cured and smoked meat: The keeping qualities of cured and smoked meats depend upon the type of cure, the length of smoking period, and the method of packaging. The storage life of such items is further influenced by the condition of the storeroom with regard to humidity, temperature and sanitation.

Growth of mold and development of rancidity in hams and bacon can be retarded by stowing such items in the chill space for current consumption and in freezer space for seasonal stocks. Since the growth of mold on cured and smoked meats is favored by the presence of condensed water, excessive humidity should be avoided. If the relative humidity is higher than recommended, it is essential that good circulation of air be maintained.

Harris and bacon which have been individually wrapped in one or more layers of paper have a tendency to retain upon the surface of the meat any moisture which may have come from the product after wrapping. This moisture, in a measure, stimulates mold and bacterial growth. If hams so wrapped are held at temperatures of 45° For above for a considerable length of time, mold and slime will form on the surface of the meat. Surface slime and mold make the ham unattractive and unpleasant to handle, but do not necessarily indicate spoilage. Accordingly, such products should be carefully inspected to determine how far the mold has penetrated. In most cases, where only the surface is affected, the mold can be removed from the meat by brushing with a stiff-bristled brush, wiping with a clean cloth moistened with a vinegar or salt-water solution, and allow-big to air dry. When the mold growth is heavy it maybe trimmed away. If the ham does not have deep cracks or abrasions, the meat underneath the surface usually is found to be perfectly sound and wholesome. When mold growth

Table 5–7. Footnotes-Continued

or spoilage is evidenced deeply between the muscles" and around the bone, a survey is usually necessary.

10 Very susceptible to mold growth or surface. Inspect and wipe often.

11 This item keeps better unwashed.

12 Export pack only for ships and oversea shipments. Ice packed lettuce will encourage the growth of mold on other commodities. The storage life shown for lettuce is lengthened substantially by trimming closely and wrapping heads individually in polystyrene film.

13 This commodity should not be stored with items such as apples and grapefruit since they will acquire an onion taste. compartments should be kept dark.

14 Early and "intermediate crop potatoes may possess better or poorer keepings qualities than potatoes shown on the table. Many lots of early potatoes are too immature for export and some intermediate crop potatoes are not suitable for export because of poor quality and condition. Extreme care must be exercised in the selection of potatoes for export *from* the middle of May to the middle of August. The quality and condition of available supplies must govern the final choice between old and new crop stock for export during the first part of this period and such factors also must govern the choice of stocks of new crop potatoes for export later in this period.

15 Deleted

16 The refrigerated storage of Florida grapefruit is not recommended for more than a limited period and then only if the fruit is inspected at intervals. Grapefruit is very susceptible to rind pitting and aging at comparatively low temperatures, especially at 38° F. (as compared with 32" F). At higher temperatures, such as 50° F the rapid development of decay is troublesome..

17 Keeping time in uncontrolled storage (dry space) is less than 3 months because of desiccation and because of swelling due to microbial activity.

18 Sweet cherries packed in sealed polyethylene bag liners can be stored for up to 21 days.

19 Asparagus held too long at 32" F is subject to chill injury. The butts of asparagus should be placed in absorbent material during storage.

20 Carrots may become bitter if stored with fruits which give off ethylene, such as apples and pears. If carrots are bitter, they should be stored at room temperature for several days before use.

2* Polyethylene liners will extend storage life an additional 7-14 days.

22 California and Arizona varieties are more susceptible to low temperature rind disorders.

23 Imperfect seals will reduce shelf life.

Much of the above information was extracted from Lutz, J.M. and R.E. Hardenburg, Agricultural Research Service, Agriculture Handbook No. 66 (October 1968). The Commerical Storage of Fruits, Vegtables & Florists & Nursery Stocks, and American Society of Heating, Refrigerating and Air Conditioning Engineers Handbook and Product Directory-1974 Applications.

5-502. Semiperishable Subsistence in Dry Storage

a. The product. The term seriperishable subsistence refers to food items that are canned, dried, dehydrated, or otherwise processed to the extent that such items may, under normal conditions, be stored in nonrefrigerated spaces. Semiperishable subsistence too often is regarded as nonperishable commodities which do not require care or protection in storage. While semiperishable subsistence is not nearly as susceptible to spoilage as perishable subsistence, spoilage can and will occur if the products

are mishandled, improperly stored, or stored for excessive periods of time. It is important to remember that the length of storage should be based on the date of packing and not on the date of receipt.

b. Storage. Careful, correct storage methods not only prevent damage to items in storage but assure speed and efficiency in the receipt, handling and issue of such items. Shipments should be segregated and clearly marked so that the oldest lots, as packed and not as received, are issued fret, unless the newer lots, show evidence of deterioration or spoilage. The particular method used for storing each item depends on the nature of the container, the nature of the commodity, and the bursting or breaking strength of the bottom layers. For example: items packed in glass containers with cork stoppers should be inverted to prevent the drying" out of the stoppers and subsequent leakages.

(1) Storage *precautions.* Care should be taken that items are not stacked so high as to cause a bursting or crushing of the bottom layers; nor should items be stacked so high that the top layer is subject to the higher temperature more prevalent near the ceiling or overhead. Stacking in close proximity to steam or other heated pipes shall be avoided. Pallets are used to raise subsistence off the floor and individual lots piled in such a way as to permit the circulation of air. around the lots. Bagged items and those requiring fumigation and insect control should not be stored in large masses in corners of the storeroom or directly against the walls; such storage leaves insufficient room for cleaning and inspecting. Palletized storage is used as this facilitates handling of the stores and reduces losses by breakage in handling. All items should be properly cross-stacked to keep the stack solid and prevent it from toppling.

(2) Storage *periods (keeping time).* The safe storage period for dry subsistence items varies greatly, depending on such elements as temperature, humidity, care in handling, protection from weather, quality of the food when received and the packing. Safe storage periods become very uncertain at extremes of temperature and under combat conditions. The fact that subsistence has been on hand up to the limit of the "safe" storage period does not mean that the subsistence should be surveyed but should be consumed as soon as practicable. Subsistence which has been on hand beyond the safe storage period should be inspected carefully for spillage, leakage, or other damage and if still good issued as soon as possible; such items will be given priority of issue over newer stocks.

c. *Causes of spoilage.*

(1) *Age.* All foodstuffs are subject to varying degrees of natural deterioration; this deterioration is inherent in the food itself. It should not, however, be confused with the action of micro-organisms, chemical agents, or other outside agents. Such facts compel an observance of the basic principle of storage that the oldest lots of the item always should be used first, except under conditions indicated in a(l) above.

(2) *Insects (roaches, flies, weevils, and moths).* Insects can cause great damage to stored food; attacking both natural and manufactured food. Food stored at temperatures between 60° and 90° F is especially attractive to insects. Infested supplies must be segregated and if not too heavily infested may be "reconditioned" for use. Cornmeal, especially, is susceptible to insect infestation and rancidity. Insect repellents should be used carefully so as not to contaminate the foods or cause damage by the absorption, by the food, of the fumigant or insecticide flavor. Roaches and flies not only contaminate the foods buy may spread disease. (See chap. 111, sect. 4 this regulation for information on pest management).

(3) *Rodents (rats and mice).* Rodents not only physically destroy food by feeding, chewing and cutting the bags for nests or nesting material, but also contaminate food with their excreta and hairs. Rodents are carriers of filth and disease; the importance of controlling these pests is evident. The most effective method of control is to prevent entry of these animals.

(4) *Physical environmental factors.*

(a) Freezing. Dry products such as grains, flour, sugar, starch, cereals and dehydrated foods, ordinarily are not injured by freezing. If foods containing relatively large amounts of water, such as canned products, are frozen, the usefulness and palatability of such products have not been harmed. However, the physical appearance may suffer due to change in consistency and texture (softening). Emulsions such as canned cheese and butter, prepared mustard, and mayonnaise may be broken (separated) by freezing although the food is not spoiled.

(b) *Heat (high temperatures).* A high temperature over 'long periods of time is very detri-

mental to the keeping of almost all food products. High storage temperature encourages bacterial growth, mold growth and insect infestation and is particularly dangerous when accompanied by high humidity. Chemical action is accelerated, causing rancidity in many items; action of the food acids naturally present within the cans is accelerated, resulting in pinholing, blackening of the interior, and hydrogen swells. High temperature is the chief cause of accelerated spoilage in canned foods and should be controlled when possible by providing adequate ventilation. Flour and associated products (barley,' cereals, cornmeal, cornstarch, cracker and biscuit, hominy, noodles, oats, rice, spaghetti and macaroni, tapioca, and uncooked wheat) are subject to insect infestation, particularly at' high temperatures. Flour and cereals will absorb odors and should be kept away *from* subsistence or materials giving off distinctive odors. Cocoa will keep years under cool, dry storage conditions. The formation of a white "bloom" (described as a "whitening" or "graying" due to storage under fluctuating temperatures) has little or no effect on the flavor of cocoa. Long periods of storage at higher temperatures may cause mustiness or rancidity. Cocoa does absorb moisture and odors; cans, therefore, should be kept tightly closed. Roasted, ground coffee rapidly develops a weak and stale flavor. If coffee is not hermetically sealed it will absorb odors affecting the flavor.

(c) *Moisture (humidity).* High humidity is detrimental to stored subsistence in many respects; accelerating the growth of bacteria and molds promoting insect infestation and causing mustiness in flour, rice and similar foods. High humidity causes products which readily absorb moisture, such as sugar and salt, to cake and become hard. Tea will absorb odors and high humidity causes it to become musty and sour. It should be emphasized that dehydrated products are perishable and should not be handled or stored carelessly. Such products are subject to moisture absorption, insect infestation and mold. A loss of flavor and discoloration (darkening) will occur with age; this action is progressive and is accelerated at high temperatures. Dried vegetables and fruits are subject to insect infestation and molding (particularly fruits) and should be inspected at frequent intervals.

(d) *Ventilation.* Where sharply fluctuating temperatures and high humidity prevail, the lack of proper ventilation may cause excessively high temperatures. Proper ventilation is one of the most important factors in protecting foods, particularly in tropical areas. In extreme cases, it may be necessary to open doors and use fans to induce circulation.

(e) *Light.* Damage from light is restricted to products that are packed in glass or transparent containers. Exposure causes color changes and may affect the flavor of foods containing, or composed of, edible oils and fats.

d. Physical factors for canned products.

(1) *Subject to spoilage.* Canned products such as meats, fish, poultry, vegetables, fruits and juices are subject to several physical environmental factors causing spoilage.

(2) Spoilage *factors.*

(a) Rust. Rust, unless it actually penetrates the can causing leakage, will not injure the contents or render them inedible.

(b) *Dents.* Dents, unless so severe as to cause leakage, do not indicate that the contents are in an unsatisfactory condition.

(c) *High temperature.* High temperatures are detrimental to all canned provisions and reduce the storage life to a considerable degree.

(d) Freezing, Freezing causes loss in palatability y and may cause breakdown of the texture. Alternate freezing and thawing may cause delamination of the protective enamel.

(3) Major *defects.*

(a) Quality change. Fading of color, loss of flavor, or softening of contents is due to chemical action and the natural aging process.

(b) *Discoloration.* Discoloration of contents on inside of can because of chemical action is found usually in products containing sulphur compounds, that is, corn, peas, and meat products.

(c) *Swells.* Swells, springers and flippers are caused either by chemical or bacterial action, or by overfilling. Regardless of the primary cause, cans exhibiting such defects should be discarded, or referred to a Medical or Veterinary officer for recommendation as to disposition.

(d) *Pinholing.* Pinholing is due to the chemical action of the food acids on the tin. Pinholing is more often found in enamel lined cans; brine-packed or vinegar-packed items, and in water-packed tits.

(e) *Flat* sours. Flat sours are caused by bacterial action, causing changes in odor, color, or turbidity of the product, but not accompanied by gas production which would cause swelling of the can.

e. *Exterior can coating.*

(1) *Purpose.* Exterior can coatings are applied to protect the tin plate from external conditions promoting rusting and, depending on the coating specified, to camouflage the bright can surface.

(2) *Types of coating.* Three types of exterior coatings are used. Specification 'IT-C-495, Coatings, Exterior, for Tinned Food Cans, lists these as follows:

(a) Type *I.* Precoated camouflage (O.D. colored coating applied to tin plate before can fabrication). Precoated cans do not have the side seam area coated as manufactured. Depending on contract requirements, the side seam may or may not be striped with O.D. lacquer following filling and sealing.

(*b*) *Type II.* Post-coated camouflage (O.D. colored coating applied to the cans sometime following filling and sealing).

(c) *Type III.* Precoated unpigmented (clear lacquer applied before can fabrication-commonly called "gold coat").

(3) *Labeling of coated cans.* Precoated cans will normally have completed label information lithographed on the body or one end of the cans. Postcoated cans will usually show only the name of the product or an abbreviation thereof since these cans have to be labeled after coating, and equipment for complete labeling is impractical for the packer to maintain. While it is intended that most postcoated cans will have as near as possible the full name stamped on the side or one end, there is the possibility that some cans will be embossed or impressed on the end only with an abbreviated legend (*See* MILL-1497.)

f. Storage periods.

(1) *General.* Table 5–8 "Dry storage of semiperishable subsistence" should be used only as a guide. This table is based on the optimum rather than the maximum storage life.

(2) *Over-aged stock.* Activities receiving a pack older than that indicated on the storage life table should not on this basis alone consider the product as unfit or undesirable. Subsistence stored for periods in excess of the storage life shown in the table, but at temperatures lower than those listed therein, should not be automatically considered as over-age stock.

(3) *Containers.* Since the container is one of the factors in the overall keeping period of an item, the container should be considered if it markedly differs: that is, flour in bags vs. cans, coffee in bags vs. coffee in vacuumpacked tins. Thus supply officers should be guided by the appearance, odor, color and condition of the item.

(4) Subsistence, *table of safe* keeping time *for dry storage* [1] *of semiperishable subsistence.*

Note. These products are not always subject to the same spoilage as are other foods. Their desirable properties of flavor, odor, and *taste* often depend upon very unstable or volatile components, and deterioration may result from a breakdown or loss of these constituents. However, excessive heat and moisture, contamination by insects, rodents and microorganisms, dirt and dust, and inadequate packaging and packing can be major factors contributing to deterioration.

Table 5-3. Dry storage of semiperishable subsistence.

Item	Packaging	Keeping time in months (approximate) 40° F.	70° F.	90° F.
Almond paste	Can	36	9	3
Antioxidant compound, food service	Bag	60	36	24
Apple:				
Regular pack	Can	48	24	12
Pie style, dehydrated	Can	48	36	18
Butter	Can/jar	36	18	9
sauce	Can	48	24	12
Baby food, strained	Jar	36	18	9
Dehydrated (instant)	can	48	24	12
Dietetic pack	can	48	24	12
Junior food	Jar	36	18	9
Juice				
Dehydrated[11]	can	72	36	18
Single strength	can	36	18	9
Spiced, rings	can	36	18	9

Table 5-8. Dry storage of **semiperishable** subsistence-Continued

	Keeping time in months (approxim			
	Packaging	40° F.	70° F.	90° F.
Apricots:				
Regular pack	Can	48	24	12
Baby food, strained	Jar	36	18	9
Dietary pack	Can	36	18	9
Dried	Carton	24	3	1
Freeze, dehydrated	Can	24	12	5
Apricot nectar:				
Regular pack	Can	48	24	12
Freeze dehydrated	Can	24	12	5
..... Asparagus	*can*	36	18	9
Baby formula preparation	Can	24	12	6
Bacon:				
Sliced	Can	48	24	12
Sliced, irradiated	Can	48	24	12
Sliced, prefried	Can/flexible package	48	24"	12
Bakery mixes, extended shelf life except biscuit, cheese cake, cookie, corn bread or pie crust mix, see specific item	Can	72	36	9
Bakery mixes, commercial	Bag/carton	12	6	3
Baking powder	Can	24	12	6
Baking soda	Carton	indef	indef	indef
Barley, pearl	Bag/carton	60	48	24
Banana, baby food, strained	Jar	24	12	6
Beans:				
Drys[12]	Bag/carton	24	12	9
Green, baby food, strained	Jar	36	18	9
Green, regular	Can (plain body)	'36	18	9
.....	Can (enam-eled)	48	24	12
Green junior food	Jar	36	18	9
Green, dehydrated	*can*	84	60	24
Green dehydrated, compressed	Can	84	60	24
Kidney	Can	72	36	18.
Lima	Can	72	36	18
Pinto	Can	72	36	18
Lima, dehydrated	Can	72	36	18
Sprouta	Can	48	24	12
wax	Can (plain body)	36	18	9
.....	Can (enam-eled)	48	24	12
White, dehydrated	Can	48	24	6
White with pork in sweet sauce	*can*	72	36	18
White with pork in tomato sauce	Can	48	24	12
Bean refried	Can	72	36	18
Beef, liver, pork, or veal:				
Baby food, strained	Jar	36	18	9
Junior food	Jar	36	18	9
Beef:				
Broth, baby food, strained	Jar	36	18	9

See footnotes at end of table

Table 5-8. Dry storage (semiperishable **subsistence—Continued**

Item	Packagin	Keeping time in months (approximate) 40° F.	70° F.	90° F.
Chunks with natural juices .	Can	60	36	18
Corned	Can	60	36	18
Diced, raw, dehydrated	Can	72	36	18
Flakes and shaped, raw, dehydrated	Can	72	36	18
With gravy	Can	72	36	18
Patties, dehydrated	Can	60	36	18
w/spiced sauce	Can	60	24	12
Beef steak, raw, dehydrated	Can	60	36	18
Beets:				
Baby food, strained	Jar	24	12	6
Junior food	Jar	24	12	6
Regular pack, Gulf states ...	Can	36	18	9
except Gulf states	Can	48	24	12
Berries; black, etc.	Can	36	18	9
Beverage base:				
Cocoa, powder	Can	72	36	24
Imitation, liquid	Bottle	24	12	6
Powder	Envelope	48	24	12
Beverage, base, liquid for post mix:				
colapi, pepper	Can	2	1	½
fruit punch, lemon-lime, orange, root beer, ginger ale, grape		18	8	3
Biscuit, mix	Can	36	18	6
Blueberries	Can	36	18	9
Bouillion, dried, cubes, beef or chicken	Can	48	24	12
Bread crumbs	Bag	8	4	2
Cabbage:				
Red, sweet, sour	can	48	24	12
Raw, diced, dehydrated anc dehydrated compressed ...	can	60	24	12
Cake, fresh				
Layer, coffee		⅙ (2 days)		
Loaf		⅐ (4 days)		
Candy				
Carmel	Box	12	9	4
Coated (bridge mix)	Box	24	12	4
.....	can	72	36	18
Hard	can	72	36	18
Starch jelly	Box	24	12	6
Carrot:				
Baby food, strained	Jar	48	24	12
Junior food	Jar	48	24	12
Puree	can	60	30	15
Regular pack	can	60	30	15
Dehydrated, compressed, N pack	can	36	18	9
Catsup:				
Regular pack	Bottl	48	24	12
.....	can	36	18	9
Dehydrated	Enve pe			
	can	72	24	6

See footnotes at end of table

Table 5–8. Dry storage of semiperishable subsistence-Continued

Item	Packaging	Keeping time in months (approxima 40° F.	70° F.	90° F.
Cereal:				
Baby food, strained, barley	Container	24	12	6
Quick cooking	Carton	24	12	6
	Can	48	24	12
Ready to eat, rolled oats	Pkg	24	12	6
Sugar, coated	Pkg	24	12	6
Chalupa shells, corn	Container	12	6	3
Cheese:				
Cheddar, processed	Can	48	24	12
Cottage; dehydrated	Can	24	12	6
Grated	Container	18	6	3
Processed, American, dehydrated	Can	36	18	9
Cheese cake mix	Bag	12	6	3
Cherries:				
Dehydrated	Can	48	24	12
Dietetic pack	Can	36	18	9
Maraschino	Jar	36	18	9
RTP (Red tart pitted)	Can	36	18	9
Sweet, dark	Can	36	18	9
Sweet, light	Can	36	18	9
Chewing gum	Carton	9	4	2
Chicken:				
Dehydrated	Can	60	36	18
Regular pack	Can	60	36	18
Baby food, strained	Jar	36	18	9
Chili *con carne:*				
w/o beans	Can	48	30	15
Dehydrated, w/beans	Can	72	36	12
Chili sauce	Bottle	48	24	12
Chives, dehydrated	Can	24	12	6
Chocolate, cooking				
Semi-sweet chips[16]	Pkg	36	18	6
Unsweetened*	Carton	48	24	12
Chocolate sirup, beverage	Can	72	36	18
Chutney sauce	Jar	48	24	12
Clams	Can	72	36	18
Cocoa, natural	Carton	36	18	9
	Can	72	36	18
Cocoanut, prepared				
Sweetened	Can	36	18	6
	Container	24	6	1
Unsweetened	Bag	24	6	1
Coffee				
Instant	Envelope	36	18	9
	Jar	72	36	18
Roasted and ground	Pouch	9	2	1
	Can	18	12	6
Cookie mix, chocolate & sugar	Can	36	18	9
Cookies	Carton	6	4	2
Corn bread mix	Can	24	12	3
Corn, cream, and whole grain styles	Can	72	36	18
Corn, dehydrated, uncooked, comp.	Can	48	24	12
Corn, chips	Pkg	1	?4	¼

See footnotes at end of table

Table 5-S. Dry storage of **semiperishable subsistence—Continued**

Item	ackagin	eeping time in ths (approxima 40° F.	70° F.	90° F.
Corn flake crumbs	Carton	24	12	6
Corn meal	Pkg	24	12	6
	Can	48	24	12
Crabapples, spiced	Can	36	18	9
Crab	Can	72	36	18
Crackers:				
Graham	Carton	4	2	1
Other than graham	Carton	12	6	3
Crumbs	Bag	12	6	3
Cranberry sauce	Can	36	18	9
Cranberry juice cocktail	Can	30	12	3
Cream:				
Coffee type, aseptically processed and packaged[19]	Bottle	60	12	3
	Can	12	6	1
Whipping, aseptically processed and packaged [7,19]	Can	12	6	1
Substitute	Can/envelope	48	24	12
Whipping, dry	Can	8	6	4
cream of tartar	Container	indef	indef	indef
Cup, ice cream, edible	Box	24	12	6
Currants, dried	Carton	24	12	6
Custard pudding, baby food strained	Jar	24	12	6
Dessert powder:				
Gelatin, base, all flavors[14]	can	72	36	18
	Container{ pkg	36	18	9
Starch, base, all flavors[14]	Can	48	24	12
	Container/ pkg	36	18	9
Instant, all flavors[14]	Can	48	24	12
	Carton	36	18	9
Doughnuts				
Cake	Pkg	1/10 (3 days)		
Yeast	Pkg	1/30 (1 day)		
Eggnog (APP)[19]	Can	12	6	1
Egg mix, dehydrated	Can	60	36	18
Eggs, whole, dry	Can	72	36	18
Emulsifier, bread and rolls	Bag/can	24	12	6
Enchiladas	Can	48	24	12
Figs	Can	48	24	12
Fish, dehydrated:				
squares	Can	60	36	18
Flavoring:				
Imitation maple or vanilla	Bottle	indef	indef	indef
Nonalcoholic, all flavors no listed	Bottle	24	18	6
Rye	Fiber drun	12	6	3
Tablet, imitation maple or vanilla	Bottle	indef	indef	indef
Flour:				
Rye[18]	Bag	24	12	6

See footnotes at end of table

Table 5–8. Dry storage of semiperishable subsistence—Continued

Item	Packaging	Keeping time in months (approximate) 40° F.	70° F.	90° F.
Wheat, bread or general purpose	Can	36	18	9
	Bag	24	12	6
Food coloring, liquid	Bottle	indef	indef	indef
Food coloring, paste	Jar	48	24	12
Food packet:				
In flight	Carton	48	24	12
Long-range patrol	Case	84	36	6
Survival, abandon ship	Carton	84	84	72
Survival. aircraft, liferaft	Can	84	84	72
Survival, general purpose	Carton	60	48	24
Frankfurter	Can	60	36	18
Fruitcake	Box	12	6	1
Fruit, candied	Jar	12	6	3
Fruit cocktail	Can	48	24	12
Fruit mix, freeze dehydrated	Can	24	12	6
Fruit puree	Can	48	24	12
Fry mix, breading	Bag	36	18	9
Garlic:				
Dehydrated	Can	48	24	12
Dry	Box	5	4	3
Gelatin, plain, edible	Container	72	36	18
Grape juice:				
Dehydrated[7]	Can	72	36	18
Single strength	Can	24	12	6
Grapefruit				
Regular pack	Can	48	24	12
Juice, dehydrated (instant)[9,12]	Can	72	36	18
Juice, single strength	Can	48	24	12
Grapefruit-orange juice blend:				
Single strength	Can	48	24	12
Grapefruit-pineapple juice blend, single strength	Can	48	24	12
Ham chunks	Can	60	36	18
Hamburgers, without gravy	Can	60	36	18
Hash, corned beef or roast beef	Can	72	36	18
Hominy:				
Grits	Container	24	12	6
Whole	can	72	36	18
Honey, extracted	Jar	48	24	12
Horseradish, dehydrated	Bottle	48	24	12
Ice cream mix and ice milk mix:				
Powder	Can	36	18	6
Icing mix	Can	72	36	18
Inhibitor, mold, bread and rolls[14]	Bag	18	9	5
Jam, fruit	Can/jar	36	18	9
	Pkg	24	12	6
Jelly, fruit	Can/jar	36	18	9
	Pkg	24	12	6
Lard, service style	Carton	12	6	3
Lemon juice, dehydrated[11]	can	72	36	18
Lime juice, single strength	can	24	12	6
Luncheon meat	Can	60	36	18
Macaroni[7]	Carton	72	36	18

See footnotes at end of table

Table 5–8. Dry storage of semiperishable subsistence-Continued

Item	Packaging	Keeping time in months (approximate) 40° F.	70° F.	90° F.
Malted cereal sirup	Can	48	24	12
Margarine	Can	36	18	9
Marmalade	Jar	36	18	9
Marshmallow	Container	12	9	1
Mayonnaise	Can/jar	12	6	3
Meal, combat, individual	Case	60	24	12
Meat spread	Can	36	18	9
Meringue powder	Can	48	24	1
Milk				
Chocolate (cocoa, flavored), dry	Envelope (Vacuum)	40	20	10
	Envelope (No Vacuum)	24	12	6
Chocolate, aseptically processed & packaged	Can	12	6	3
Dry, non-fat	Can	32	16	8
	Drum/bag/carton	24	12	3
Evaporated[5]	Can	24	12	6
Filled dry, including chocolate	Can	24	12	6
Ice and milk shake mix, dehydrated	Can	24	12	6
Malted, dry	can	48	24	9
Whole, dry	Can (zero oxygen pouch)	6	3	1
Whole, aseptically processed and packaged[19]	can	12	6	1
Mincemeat	Can	48	24	12
Molasses	Can	48	24	12
Monosodium glutamate	Container	indef	indef	indef
Mustard, prepared	Can/jar	36	18	9
Mushrooms	can	48	24	12
Noodles:				
Chow mein	can	8	4	2
Egg[14]	Carton	?2	36	18
Nuts:				
Shelled, roasted	can	60	24	12
Unshelled	Bag	24	12	6
Okra	can	48	24	12
Olives:				
Green	Jar	48	24	12"
Ripe	can	48	24	12
Olive oil	can	18	6	4
Onions, dehydrated and dehydrated compressed	can	48	24	12
Onions, whole, acidified	can	36	18	9
Orange juice:				
Dehydrated (instant)"	can	72	36	18
Single strength	can	48	24	12
Parsley, dehydrated	can	30	24	12
Peaches:				
Baby food, strained	Jar	36	18	9
Dietetic pack	Can	48	24	12

See footnotes at end of table

Table 5–8. Dry storage of semiperishable subsistence-Continued

Item	Packaging	Keeping time in months (approximat 40° F.	70° F.	90° F.
Regular pack	Can	48	24	12
Slices (freeze dehydrated)	can	24	12	6
Peanut butter	Can/jar	36	18	9
Pears:				
Baby food, strained	Jar	40	20	10
Dietetic pack	Can	36	18	9
Freeze dehydrated	Can	24	12	9
Regular pack	can	36	18	9
Peas:				
Baby food, strained	Jar	40	20	10
Blackeye	Can	72	36	18
Dehydrated, compressed	Can	60	24	12
Drys[12]	Bag/carton	24	12	9
Green	can	72	36	18
Peas and carrots	Can	60	30	15
Peppers, green dehydrated	can	60	24	12
Peppers, pickled, cherry	Jar	36	18	9
Peppers, jalapeno	can	24	12	6
Peppers, red sweet	Can	48	24	12
Pickles:				
Cucumber, cured	Jar	48	24	12
	can	24	12	6
Cucumber, fresh pack	Jar	36	18	9
	can	18	9	4
Mixed	Jar	48	24	12
	Can	24	12	6
Relish	Jar	48	24	12
	can	24	12	6
Pie crust mix	can	36	18	6
Pie filling, prepared fruit, apple, blueberry, cherry, peach, lemon[16]	can	24	12	6
Pie shell, graham cracker	Container	8	4	2
Piementos	Can	48	24	12
Pineapple:				
Dietetic pack	can	48	24	12
Freeze dehydrated	can	24	12	6
Juice, dehydrated”	Can	72	36	18
Juice, single strength	Can	48	24	12
Regular pack	can	48	24	12
Plums:				
Dietetic pack, red	can	36	18	9
Dietetic pack, green	Can	48	24	12
Regular pack, red	Can	36	18	9
Regular pack, green	can	48	24	12
Popcorn, unpopped	can	72	36	18
	Carton	2	¼	⅛
	Cello bag	24	3	1
Pork chops, raw, dehydrated	can	60	36	18
Potato:				
Chips	Pkg	1	½	¼
	Can, air	4	2	1
	Can, nitrogen	24	12	6
	Can, vacuum	12	6	3

See footnotes at end of table

Table 5--8. Dry storage of **semiperishable** subsistence-Continued

	Keeping time in months (approxima		
Packaging	40° F.	70° F.	90° F.
Sticks	Can	48	24	12
Sweet	Can	48	24	12
Sweet, instant, dehydrated	Can	48	24	12
White	Can	60	30	15
White, dehydrated, granules	Can	60	36	18
White, dehydrated, granules–8% H_2O	Can	24	12	6
White, dehydrated, slices	Can	36	18	9
White, dehydrated, slices-8% H_2O	Poly bag	1 6	18	4
White, dehydrated, slices–8% H_2O	Kraft bag	12	6	3
Mix, dehydrated for french fries	Can	18	9	5
	Bag	12	6	3
Prunes				
Baby food, strained	Jar	18	9	6
Dehydrated/pitted (low moisture)	Can	24	12	5
Dried	Can	36	18	9
Dried	Carton	18	9	5
Dried, soaked	Can	36	18	9
"Pumpkin	can	48	24	12
Raisins, dried	Can	36	18	9
	Carton	18	9	5
Ration, supplement aid station	Case	72	36	18
Ravioli w/meat sauce	Can	48	24	12
Rice				
Instant[14]	Carton	36	18	9
Milled)'	Bag	48	24	12
Parboiled[14]	Container/bag	30	20	10
Rolls, fresh				
Bagel	Pkg	1/30 (1 day)		
Sweet or finger	Pkg	1/15 (2 days)		
English muffin	Pkg	1/4		
Salad dressing, spoonable[4]	Can/jar	8	5	2
Salad dressing, pourable[4]	Bottle	7	5	2
Salad oil[9]	Can	24	12	6
Salmon	Can	72	36	18
salt:				
Celery, garlic, onion	Container	72	36	18
Substitute	Envelope	indef	indef	indef
Table[6]	Bag envelope	indef	indef	indef
Sauces, Hot, Kitchen, Meat, Soy or Worcestershire	Bottle	60	30	15
Sauerkraut	can	36	18	9
Sardines	Can	72	36	18
Sardines in tomato sauce	Can		15	8
Sauce mix, brown gravy, spaghetti, taco seasoning	Can	36	18	9
Sausage, pork, link	Can	60	36	18
Shortening compound:[10]				
Bakery type[9]	Can/cube	48	24	12
Deep fry, cooking type, fluid	Can	48	24	12

See footnotes at end of table

Table 5-8. Dry storage of semiperishable **subsistence—Continued**

Item	Packaging	Keeping time in months (approximate) 40° F.	70° F.	90° F.
Deep fry, cooking type, plastic	;an	48	24	12
General purpose regular	Can/cube	48	24	12
General purposes, high stability	Can/cube	60	30	15
Shrimp	Can	72	36	18
Shrimp, dehydrated	Can	60	36	18
Sirup:				
Blended	Can	72	36	18
Maple sirup, imitation	Bottle/can	72	36	18
Soup:				
Baby food, chicken, strained	ar	36	18	9
Beef, instant, dehydrated	‘kg	24	12	6
Beef, noodle, dehydrated	‘kg	24	12	6
Beef, vegetable, noodle, dehydrated	Can	36	18	9
Chicken, chunk, dehydrated	?kg	24	12	6
Chicken or chicken flavored instant dehydrated	?kg	24	12	6
Chicken, noodle, dehydrated	Can	60	30	15
	?kg	24	12	6
Condensed[13]	Can	72	36	18
Cream of onion, instant, dehydrated	?kg	24	12	6
Cream of potato, instant, dehydrated	?kg	24	12	6
Green pea, simmer type, dehydrated	Can	60	30	12
	?kg	24	12	6
Onion, dehydrated	Can	60	30	12
	Pkg	24	12	6
Onion, instant, dehydrated	?kg	24	12	6
Ready to serve	Can	48	24	12
Tomato-vegetable w/noodle, dehydrated	Can	48	24	9
Vegetable, dehydrated	Pkg	24	12	6
Soup and gravy base:				
Beef flavored	Can/jar	60	30	15
	Envelope	24	12	6
Chicken, flavored	Can/jar	60	30	15
	Envelope	24	12	6
Ham flavored	Can/jar	60	30	15
	Envelope	24	12	6
Sour cream sauce mix	Can	24	12	4
Spaghetti[14]	Carton	'72	36	18
Spices, seasoning, herbs[6]	can	48	24	12
	Container	36	18	3
	Bottle	36	18	9
Spinach:				
Baby food, strained	Jar	36	18	9
Dehydrated, compressed	Can	60	24	12
Junior food	Jar	36	18	9
Regular pack	Can	48	24	12
Puree	can	48	24	12
Starch:				
Corn, edible	Carton	96	48	24

See footnotes at end of table

Table 5–8. Dry storage of semiperishable subsistence—Continued

Item	Packaging	Keeping time in months (approximate) 40° F.	70° F.	90° F.
Pregelatinized, edible[14]	Can/bag	96	48	24
Sugar:				
Brown[17]	Carton/bag	36	18	4
Confectioners[17]	Carton/bag	36	18	6
Refined, granulated	Bag/can, envelope	indef	indef	indef
Sugar, substitute	Envelope	indef	indef	indef
Tamales	Can	48	24	12
Tapioca[14]	Carton	96	48	24
Taco shells, corn	Container	12	6	3
Tea				
Black, bags or loose	Can/carton	36	18	9
Instant	Envelope	36	18	9
Tomato:				
Juice, concentrated 3 + 1	Can	36	18	9
Juice, single strength	Can (plain body)	36	18	9
	Can (enameled)	48	24	12
Paate, instant, dehydrated	Can	72	36	18
Paate, regular pack	Can	36	18	9
Puree	Can	48	24	12
Regular pack	Can	48	24	12
Tomatoes and okra	Can	48	24	12
Topping, dessert:				
Prepared, ice cream, non acid syrup	Can	72	36	18
Prepared, ice cream, fruit acid syrup	Can	36	18	9
Dehydrated	Can	36	24	6
Tortillas, corn	Can	36	18	9
Tuna:				
Dietetic water pack, no added salt	Can	72	36	18
Oil pack	Can	72	36	18
Water	Can	72	36	1 8
Turkey				
Regular pack	can	72	36	18
Loaf	Can	72	36.	18
Vegetable:				
Baby food, mixed strained	Jar	36	18	9
Juice, single strength	Can	36	18	9
Mix, dehydrated, compressed	Can	36	18	6
Vinegar:				
Liquid	Bottle	60	30	15
Synthetic, dry	Flexible bag	24	12	6
Water	Can	120	60	30
Wheat base[2, 14]	Bag	48	36	12
Yeaat, bakera, active dry	Can	6	1	¼
Yeast food	Bag	48	24	12

Table 5-8. Footnotes

[1] In general, relative humidity 50–55 percent. Metal cans are susceptible to rust and most boxed or bagged food to mustiness or molding above r, h. 60 percent.

[2] Flour should be stored under cool, dry conditions. The major problem is protection against dampness, insects and rodents. L-ow temperatures, 32–40° F, protect against

Table 5-8. **Footnotes—Continued**

insects, relative humidity greater than 70 percent leads to mustiness. Best storage conditions are at temperatures below 50° F and approximately 60 percent relative humidity.

[3] Designed to be edible after one month at 140° F.

[4] Separates at high temperatures or after freezing.

[5] Humidity above 90 percent will cause caking. "Caked" salt is usable.

[6] Above 100° F there is complete loss of flavor in less than 6 months. 'Whole" spices keep longer than "ground" spices.

[7] Guaranteed to whip only if stored below 50° F.

[8] Cases should be turned every 30 to 60 days to prevent separation of butterfat. Separated *or* grainy milk can be used for cooking.

[9] When held below 32" F may show solid material which will disappear on warming.

[10] If held above 90° F changes may occur in texture unfavorable to normal creaming properties.

[11] Store at cool temperatures below 75" F during the first 3 months.

[12] High temperatures harden, high humidity causes molding.

[13] Cream style soups break down on freezing, but are not spoiled.

[14] Highly susceptible to damage by moisture.

[15] Freezing alters appearance of starch thickening. Baking restores desirable appearance.

[16] Do not stem near other material capable of imparting odor to chocolate.

[17] Keeping time based on relative humidity not more than 60 percent. For storage longer than 1 month, sugar should be covered with tarpaulins and not stored on damp or concrete floors or near cold walls.

[18] Rye flour loses its most delicate flavor after 2 months at 40° F, 1 month at 70° F, or 1 week at 90° F. After this time further flavor change is very slow. It is said that only experts can detect this first, subtle flavor change.

[19] These items should be stored at temperatures below 72° F. For long holding, chill storage is recommended. Do not freeze.

(5) *Chill Storage of Selected B-ration components.* The following guidance is provided for storage of selected canned B-ration components in commercial warehouses in refrigerated storage at temperatures between 31½° F and 34?42° F and at a relative humidity of 55 percent or less.

Table 5-9. Selected B-Ration Components

Item	*Approx. Storage life (months)*
Apples, pie style, dehydrated	48
Applesauce, instant	48
Apricots, freeze dehydrated	36
Bacon, prefried	54
Beans, green, dehydrated	100
Beef chunks, w/natural juices	60
Beef, corned	60
Beef patties, dehydrated	60
Beefsteak, dehydrated	60
Cabbage, raw, diced, dehydrated & dehydrated compressed	72
Cherries, dehydrated	60
Cheese, processed, American, dehydrated	42
Chicken, boned	60
Chicken, dehydrated	60
Chili con came, w/o beans	48
Egg mix, dehydrated	60
Fish squares, dehydrated	60
Flour, wheat, bread	54

Table 5-9. Selected B-Ration Components-Continued

Item	*Approx. Storage life (months)*
FranHurters	60
Fruit mix, freeze dehydrated	36
Ham, chunks	60
Hamburgers w/o gravy	60.
Luncheon meat	60
Onions, dehydrated	60
Parsley, dehydrated	30
Peaches, freeze dehydrated	3 6
Pears, freeze dehydrated	3 6
Peas, cooked, dehydrated	72
Peppers, green dehydrated	72
Pineapple, freeze dehydrated	36
Pork chops, dehydrated	60
Pork sausage	60
Potatoes, sweet, instant	60
Potatoes, white, granules dehydrated	60
Potatoes, white, slices, dehydrated	54
Prunes, low moisture	36
Rice, parboiled	30
Shortening compound, general purpose	60
Shrimp, dehydrated	60
Spinach, cooked, dehydrated	60
Tomato paste, instant	72
Vinegar, dry, Synthetic (can ad flex-pack)	30

Section *6.* MISCELLANEOUS COMMODITIES

5–601. General

This section includes some of the more common miscellaneous commodities stored in military installations but is not intended as a complete list. This section, prescribes the approved methods and practices for storing and handling the listed materials. Storage and handling methods that are to be observed with respect to other commodities will be in accordance with the principles and practices included in the other chapters and sections of this regulation or as may be prescribed by the appropriate military service. " "

5–602. Batteries

This paragraph deals with primary batteries (mercury, silver-oxide, manganese-dioxide, carbon-Zinc (flashlight), and other dry or reserve batteries) and secondary batteries (lead-acid> nickel-iron alkaline, nickel-cadmium, and silver-zinc). Primary batteries cannot be recharged efficiently (a flashlight battery) and are of two types, dry and reserve. A dry battery is commonly referred to as a dry cell battery and a reserve battery is one that must be activated by the addition of a fluid, usually water. A secondary battery is one that can be recharged repeatedly (an automobile battery is a good example of such a battery) and" activated by the addition of electrolyte. Buildings with metal roofs must not be used for storage of batteries, since these types absorb and conduct heat to a high degree. Likewise, batteries will not be stored in direct sunlight. Batteries can be stored on pallets, in bins or racks, depending on the quantity and type to be stored. 'This Side Up" batteries will remain in their original containers until ready for issue or use. Batteries removed from original containers must never come in contact with steel, steel shelving, or other metal objects which can cause short circuits or discharging. Small cell batteries must be stored in a cool well-ventilated area. It is the responsibility of the storage supervisor to ensure that batteries are segregated by type, properly tagged, and stored in such a manner that the oldest stock is issued first. The expiration date will be annotated on the document when the issue is made. The expiration date will be ascertained in accordance with pertinent tables which indicate the allowable storage life in months depending upon how long the battery has been in storage and the climatic zone to which the battery will be shipped. Specific details for the Department of the Army will be found in SB 11-30 and TM 11–415; for the Department of Air Force, T.O. 00-2$213; for the Department of the Navy and the US Marine Corps, the Electronic Supply Office instruction (ESOINST 4440.85, Dry Cell Battery Procedures). At the time the exterior container is opened, each intermediate or unit pack will be appropriately marked with the expiration date.

a. *Primary batteries.* The deterioration of all primary batteries during storage, standby, or when in service is caused by chemical action within the cells or from the loss of moisture through the sealing material. Proper storage conditions reduce this chemical activity to a minimum, resulting in extended battery life. It is recommended that batteries of the reserve type be shipped and stored in a completely dry state, as they do not deteriorate if kept completely dry.

(1) Storage *temperatures.* Primary batteries are perishable commodities and, when possible, will be stored in refrigerated space or in warehouses having constant or controlled temperature, as temperature is the most important factor to be consid*ered in* the storage of primary batteries. The chemical activity which causes battery deterioration is lessened considerably as the storage temperature is lowered. Primary batteries will be stored in the coolest practicable dry, ventilated storage space. Storage space temperature within the range -30° F to 35° F is recommended. This temperature range is preferable, provided such cold storage facilities are available without appreciable cost; however, the usual refrigerated storage space available in the supply system at this time provides temperatures between 35° F and 50° F with relative humidity of 50 percent to 80 percent. This is satisfactory for normally moving stocks. For long term storage, however, dry batteries will be stored in areas having temperatures as close as possible to -30° F but not lower than this and, if possible, will never be stored where temperatures exceed 50° F. Nonrefrigerated storage areas for dry batteries must have as constant a temperature as possible, since wide temperature variations are as damaging as high temperatures. To prevent short-circuiting in the voltage socket terminals as a result of "sweating," dry batteries, when removed from refrigerated storage, will not be removed from the polyethylene bags in which they are packaged until they have warmed up to an ambient temperature. -Exceptions to refrigerated storage requirements

will be as directed by the individual DOD component.

(2) *Ventilation.* Some dry batteries generate small quantities of gas, particularly during the first few months after manufacture. To avoid the possibility of an accumulation of gas, adequate ventilation in the storage area will be provided.

(3) *Testing.* Maintenance during storage consists largely of testing stored dry batteries at periodic intervals in order to maintain depot stocks at a. high level of reliability.. Periodic tests are not made on reserve batteries because they are stored in a dry, inert condition, with a desiccant, in airtight cans or metallic bags. The test of a battery consists of taking a voltage reading across a specific load resistance for each battery.

b. Secondary batteries. Secondary batteries will never be piled on top of one another, rather, they will be stored on storage racks. These racks will be made of loose, flat boards-nails not being required. The uprights will be about 10 inches high and 12 inches wide. Shelf boards can be of any convenient size. The rack is assembled with batteries sitting on the shelves and on either side of the uprights. The batteries must be close enough together to hold the upright rigid.

(1) *Lead-acid batteries.*

(a) Charged and wet. When received charged and wet, the cells are completely assembled, contain electrolyte, are fully charged, and ready for use. The batteries will be stored in a fully charged condition and care must be exercised in handling. When stored in this manner, batteries must be kept fully charged either by continuous application of a trickle charge, or by a periodic recharge once each month in temperatures below 80” F. When charging batteries, the vent caps will be kept in place to avoid electrolyte spray. Care will be taken to assure that vent caps are functioning. It should always be assumed that an explosive mixture of gases exists in and around charging batteries, unless positive steps have been taken to eliminate them. For this reason, anything that could ignite these gases such as an open flame, a spark or smoking should be prohibited. Water will be added and specific gravity checked every week. Because equalizing charges are given, generally, at 30-day intervals, the batteries will be stored in a readily accessible place. As the temperatures of the storage area or zone and the age of the battery have a direct bearing on the frequency at which equalizing charges must be given, the individual activity storing batteries will determine the schedule of equalizing charges. Batteries maybe stored several months in this manner and are available for use at any time. New batteries that have electrolyte in them and that have been given their frost charge, or batteries that have been in service and are not worn out, must be stored in as cool a location as possible, namely, between 60° F and 80° F. Wet charged batteries should not be stored directly on a concrete floor. Lead-acid batteries, depending on the quantity and size, will be stored in racks or bins in an upright position to prevent spillage or leakage of electrolyte.

(b) Charged and dry. Batteries may be stored dry indefinitely. The plates are fully charged, dried and stored either in their containers or separately. Rubber insulators may be stored dry, but wood separators must be stored in water or in a very weak electrolyte solution in a sealed container. This method is not generally used except for new batteries which are shipped dry by the manufacturers. Batteries received charged and dry will be kept closed tightly to prevent breathing. The batteries can be palletized or stored in bins or racks depending on the quantity and size of the batteries.

(c) *Uncharged and dry or moist.* Uncharged and dry or moist batteries will be stored and handled in the same manner as charged and dry batteries.

(d) Charged and moist. For moist storage, batteries are fully charged and the electrolyte then removed and stored separately. The batteries will be sealed with paraffin wax or battery sealing compound. When batteries are stored in this manner, the seals must not be disturbed until the batteries are ready to be used. This method is least desirable since plates and separators are subject to damage.

(2) *Nickel-iron alkaline batteries.* Wet discharged nickel-iron alkaline batteries may be stored for temporary periods in any state of charge without deterioration. Where prolonged storage is anticipated, the battery will be discharged to zero voltage and short circuited in trays of five or six cells each. Store in a clean, dry area with the solution at the prescribed level. Make certain the filler caps are in a closed position. Nickel-iron alkaline batteries are shipped dry only for oversea shipment. Electrolyte accompanies the battery in a separate container, along with specific instructions for filling and charging the battery.

(3) Nickel-cadmium batteries. Wet batteries

will not be stored with intertray connectors attached. In addition, cell tops will be protected with petroleum jelly to protect the metals. Batteries will be stored in a cool place which is free from dust and moisture. A cool dry place is defined as 60° F to 80° F and less than 60 percent humidity.

(4) Silver-zinc *batteries.* Silver-zinc batteries, uncharged-dry, may be stored indefinitely.

(a) Dry batteries which are shipped in a dry condition and which will not be placed in service for . . . . . ,30 days or more will be stored in the dry condition at "a temperature not to exceed 60° C (150° F).

(b) Wet batteries stored for 30 days or longer, must be discharged. Tape all cell vent valves with cellophane tape.

(c) Wet batteries may be safely stored at temperature from O" to 110° F. However, the lower temperatures within this range are more satisfactory for storage.

(5) *Safety measures.*

(a) Face shields, aprons and rubber gloves will be provided for personnel handling caustic materials.

(b) Facility for quick drenching of the eyes and body will be provided within 25 feet of the work area for emergency use.

(c) Facilities will be provided for flushing and neutralizing spilled electrolyte, for fire protection and for adequate ventilation of battery charging areas to prevent a build-up of explosive gas-air mixture,

5-603. Electronic Material

Tubes will be stored in racks or bins with sufficient shelving to prevent crushing. Tubes will be stored in original cartons if possible. Special storage instructions on the outside of the tube shipping containers will be complied with as appropriate. When moving tubes, sufficient protective shock absorbing material will be used to prevent damage.

a. Radioactive *material. See* paragraph 5-626 for guidance on this type material.

b. Photo tubes. Strong light levels and high temperatures contribute to the deterioration of photo tubes. Photo tubes must be stored out of the direct light and away from high temperature areas as heaters, etc.

c. *Crystals.* Crystals, when in storage, will not be stored adjacent to electrical wiring. Protection can be afforded, if necessary, by storing each crystal in a metal container or wrapping each crystal in metal foil.

d. Magnetrons, klystrons, traveling-wave tubes, backward-wave oscillators (carcinatron). These items must be stored away from magnetic fields which may be generated by adjacent equipment or wires. Interaction of magnets must also be avoided; therefore, these items must never be stored bare or without both an inner and outer container.

e. *Tubes.*

(1) Large glass tubes will be stored with extreme care to ensure maximum safety of personnel as well as for maximum tube protection.

(2) When storing tubes with fins, care must be exercised to prevent fin damage. If fins are crooked or bent, attempts to realign them may affect tube properties.

(3) Shipping guards or dust covers are commonly used to protect critical or fragile elements from damage. These protective items must remain in place during storage.

f. Other electronic material.

(1) Storage. Electronic equipment and bulk boxes of maintenance repair parts and components will be palletized wherever practicable. Components can be stored on frame pallets, depending on the quantity, size, and shape of components to be stored. Long heavy boxes of items such as wave guides and antennas should be kept in racks, preferably on rollers.

(2) *Temperature control.* Because the precision components of electronic equipment are susceptible to corrosion, mold, and fungus growth, temperature control is desirable in all warehouses where this material is stored. A dry warehouse is essential. At certain activities, temperature variance is so slight that mechanical controls need not be installed. A good temperature for the storage of electronic material is 70° F.

(3) *Humidity control.* Because it is impractical to apply preservatives to all types and parts of electronic equipment, control of relative humidity in storage areaa is desirable for long term storage. Fluctuating humidity and temperature causes condensation within the equipment, which results in rust. By the use of dehumidified storage space, the life expectancy of the equipment is increased considerably and additional preservation is reduced to a minimum. Controlled humidity storage space is particularly desirable in areas having high humidity and where long term storage is intended. Electronic

material stored in dehumidified warehouses ordinarily will not require additional preservation. In dehumidified storage, open-framework packing cases can be used to provide complete ventilation.

(4) *Assembly of complete unite.* To facilitate stock control, issue, and inventory, complete equip ment will be stored as a unit. This is recommended also for the storage of complete sets of spare parts. In some instances, wave guides, antennaa, and hoists mechanisms are too bulky to be stored with other components, but will be conveniently located so that such items will not be overlooked when the equipment is assembled for issue.

(5) *Stock. issue.* Electronic material should be stored in issuable condition and in such a manner to allow issue of older material first, to the extent practicable. An effective method is to position new receipts and stocks being rewarehoused in a fashion to permit ready access to older material by stock selection personnel. Storage managers should periodically monitor stock issue procedures to ensure compliance at the warehouse level.

5–604. Photosensitized Materials (Film and Paper) and Flash Bulbs.

a. *Sensitized materials.* Unexposed photosensitized materials are perishable and deteriorate with age. Improper storage results in loss of emulsion sensitivity, increased fog, inferior tone reproduction, and other defects that may render the material useless. The presence in the storage area of heat, moisture, X-rays, radioactive material, atomic fission radiation, and certain gases accelerate deterioration. Careless handling damages the package and ruins the contents. Assets and consumption reporting on a quarterly basis, rapid turnover, and careful handling will maximize the usage of this commodity.

b. Relative humidity control. The required relative humidity for sensitized materials ranges from 30 to 60 percent with 50 percent considered as ideal. A constant relative humidity will be maintained.

c. *Temperature control.* Photosensitized materials will be stored at temperatures of 50° F or lower. A constant temperature will be maintained. Regardless of how photosensitized materials are packaged, temperatures should be controlled in the storage areas.

d. *Refrigeration.* Refrigerated space always should be utilized for proper storage of photosensitized materials. The required condition within the refrigerated space will be a maximum temperature of 50° F and constant relative humidity within the range of 30 to 60 percent. Leakage of moist air from the outside should be reduced by using an air lock at the door. If the relative humidity cannot be held as required, the sensitized material should be placed in vaportight containers inside the refrigerators.

e. *Hazards.*

(1) *Harmful gases.* Sensitized materials will be protected against harmful gases. High concentration of formaldehyde, hydrogen sulphide, ammonia, illuminating gas, mercury vapor, industrial gases, exhaust from engines, vapors of solvents, cleaners, and turpentine can damage photographic emulsions.

(2) *X-rays, radioactive and atomic* fission *radiation.* When storage of packaged photosensitized materials near X-ray machines, radar, radioactive, or atomic fission radiation cannot be avoided, the material will be placed in facilities shielded with an adequate thickness of lead or other suitable barriers.

f. Operations.

(1) Storage. Immediately upon receipt, photosensitized material will be stored under specified optimum conditions. These optimum conditions will be utilized at storage or holding points within the limits of resources available. Deviation from the optimum storage conditions for storage of photosensitized materials is authorized whenever prescribed storage facilities (refrigerated) are unavailable and the expenditure of resources to modify existing or construct new facilities for such purpose cannot be economically justified. Photosensitized material will be placed on shelves, dunnage, or pallets allowing sufficient space between packages for adequate circulation of air. Refrigerators utilized for photosensitized material will not be used for the storage of food or water in any form. Likewise, these materials regardless of level of preservation and packaging will not be stored in damp basements, on damp ground, near escaping steam, steam pipes, boiler rooms, windows, on top floors of uninsulated buildings, or near other sources of heat. Each lot of material will be stored according to the expiration date that is placed on the package by the manufacturer.

(2) Handling. Photosensitized materials should be moved to refrigerated storage immediately upon receipt at all points of destination. These materials

will never be permitted to stand on docks, loading platforms, loading ramps, etc. The material should be moved by refrigerated carriers and unloaded directly into refrigerated storage. In other words, all photosensitized materials should be maintained under optimum temperature and relative humidity condition from time of shipment from the manufacturer's plant until placed in use by the using activity to assure preservation in the best condition for the longest period of time.

(3) *Turnover. The* objective should be to have as rapid turnover as is economically possible and to use photosensitized materials before the expiration date. All packages of the photosentized materials are stamped by the manufacturer with an expiration date (month and year). This date gives the life expectancy of the sensitized materials under normal nonrefrigerated storage conditions. Improper storage conditions can render these materials useless long before the expiration date is reached. Photosensitised material will be issued according to the "Expiration Date" shown on the package. That is to say, the package with earliest expiration date will be issued first. Sensitized material stored under the optimum conditions specified herein will be issued for the following period after the stamped expiration date:

Materials	Domestic	Overseas
(a) Black and white	12 months	6 months.
(b) Graded paper	12 months	6 months.
(c) Variable contrast paper	12 months	6 months.
(d) Color, camouflage detection, and infrared film.	6 months	0 months.
(e) Polaroid type material	No extension.	

Photosensitized materials will be tested in accordance with the procedures and schedule as set forth in service/agency Quality Control Standards. Materials which have not been used within this time period or are suspected of damage in storage or handling will not be discarded without being tested. Often only partial impairment of speed and contrast will have taken place and the material will still serve adequately for training or noncritical use.

g. Storage *of photographic chemicals.*

(1) The optimum storage conditions for all photographic chemicals are at temperatures between 70° and 75° F and at a relative humidity between 20 and 40 percent.

(2) The recommended storage conditions for specific types of photographic chemicals are as follows:

(a) Dry chemicals in hermetically sealed containers at temperatures up to 90° F and relative humidity.

Note. Sealed metal containers do not require special protection except where conditions could cause container corrosion or deterioration

(*b*) Dry chemicals in containers with moisture barriers at temperatures up to 90" F. and at relative humidity up to 50 percent.

(c) Liquid chemicals in hermetically sealed containers at a temperature between 70° and 80° F and any relative humidity.

(d) High humidities will be avoided where possible to prevent deterioration of fiberboard packing cartons,

(e) These instructions are applicable to those photographic chemicals discussed. Where the manufacturer specifies special considerations, the manufacturer's instructions will be followed.

h. Flash bulbs. Personnel who store, handle, and ship flash bulbs should be cautioned about the fire hazard which exists from unpackaged or improperly packaged bulbs being fired or exploded by radar beams. Normally, flash bulbs should be shipped in full case lots. If not possible to ship in full case lots, broken case lots will be packed in accordance with Federal Specifications W-L-122. Bulbs will not be stored near sources of radiated energy unless suitably protected by containers which are impervious to such radiation.

5-805. Self-Sealing Fuel Cells

a. Deterioration. All self-sealing fuel cells deteriorate with exposure to light, heat, and improper handling.

b. Precautions to be taken. When handling and storing self-sealing fuel cells the following precautions should be observed.

(1) Store cells in clean, dry, dark and cool warehouses.

(2) Store in shipping container, if available, and do not remove cell from shipping container until needed. Save empty containers for storing used cells.

(3) Use frames or vertical dunnage to prevent crushing or distorting when more than four containers of cells are stacked.

(4) Uncrated cells should never be stacked but should be stored in contoured racks, resting on the widest side where there are no fittings.

(5) For the support of uncrated cells, the use of paper tubes inserted within the cell is recommended.

(6) The cell should never be allowed to rest on protruding fittings. When crated, the proper position will be indicated on the container by arrows.

(7) While in storage, all openings will be covered to prevent the entrance of foreign materials.

(8) Internal support will be installed in all semiflexible cells to prevent distortion.

(9) Cells with external supports will not be stored without these supports.

(10) Never roll or drag a cell.

5-606. Internal Combustion Engines

a. *Other than aircraft.* When storing internal combustion engines, the following precautions should be observed:

(1) Engines should be stored in a clean, dry area which is not subject to extreme variations in temperature.

(2) Engines should be stored on dunnage, pallets, skids, or in racks depending on the size, type of engine, method of pack, and quantity to be stored.

(3) Engines are not to be turned over or cranked while in storage because of the danger of damaging the coating of preservative compound on the cylinder walls and on all moving parts.

(4) Engines in storage, other than dehumidified storage, should be treated periodically with preservative compounds.

(5) In nondehumidified storage, periodic spot checks on 5 percent of the engines on hand should be made at intervals of approximately 6 months. If deterioration is apparent, a complete check of all engines should be made and engines showing deterioration should be represerved.

(6) In dehumidified storage, normally, engines do not require as much attention; an annual check of 1 percent of the engines in stock should be sufficient to insure the engines being operable when required.

(7) A different group of engines should be selected for each spot check.

b. Aircraft. Storage of aircraft engines will conform to specific instructions of the appropriate military service.

5-607. Lubricating Oils and Greases

When storing oils and greases the following precautions should be observed.:

a. Store in fire resistant, sprinklered buildings or warehouses.

b. If a general warehouse is used, storage should be in end zones with immediate access to exterior doors.

c. Oils and greases should be separated from blocks of other materials by aisles not less than 3 feet wide.

d. Oils and greases should be segregated from highly combustible supplies.

e. Exteriors of containers should be free of oil and grease.

f. Containers should be inspected before being placed in storage and periodically thereafter. Containers which show signs of leakage, excessive corrosion, or are otherwise unfit, should be removed from storage and contents should be transferred to satisfactory containers.

g. Oils and greases in bulk storage should be palletized.

h. The height of stacks and the size of blocks should comply with regulations governing floor load capacities and ceiling heights.

5-608. Paints

Paints, varnish, lacquers, shellac, and thinners should be stored as follows:

a. Where facilities are available, paint and paint materials will be stored in fire resistant storage buildings.

b. If such space is limited, supplies bearing Interstate Commerce Commission red labels (flammable types) will be given preference.

c. If a general storage warehouse is used, storage will be in end zone with immediate access to exterior doors.

d. Containers of paints will be segregated from highly combustible supplies.

e. Before placing in storage, containers will be inspected for leaks.

f. Good ventilation will be provided.

g. Containers of paint should be palletized before storing.

h. Containers of paint should be located so as to facilitate issue on first in, first out basis.

i. Paints, in general, should be stored in a cool dry place with the exception of bituminous camouflage, water emulsion, and latex-type paints. In colder climates these types should be stored in heated buildings to prevent freezing.

j. Store in nonfireresistive, unsprinklered warehouse as a last resort only.

5-609. Life Floats

Life floats should be stored in clean, dry, and covered area;s ould not be exposed to the direct rays of the sun or extreme heat; and should be stored with caution against moisture accumulation in webbing and ropes; floats should be reversed or turned periodically. When handling life floats, care should be taken to prevent damage to cork floats and webbing.

5–610. Linoleum

When storing and handling linoleum the following precautions should be observed:

a. Linoleum should be stored in a vertical position and in the original shipping container.

b. Heated or unheated storage of linoleum is satisfactory; temperature from 0° to 120° F will not harm it.

c. At low degrees, linoleum should be handled carefully as it will crack if dropped.

d. When removing linoleum from trucks and boxcars do not drop crates over stringers.

5-611. Fiber Rope

When storing fiber rope, the following precautions should be observed:

a. Fiber rope will always be stored in a cool, dry, and covered space as heat and moisture cause deterioration.

b. When manufactured, fiber rope is impregnated with oil which adds 10 percent to the weight. The rope deteriorates as the oil leaves the rope.

c. Rope will be protected from the direct rays of the sun.

d. Adequate ventilation will be maintained in rope storage areas at all times.

e. When properly stored, rope loses its strength because of age at about 2 percent per year; life of rope will be shortened by presence of mold, acid, or water.

f. Rope will not be stored near acid, batteries, chemicals, or alkalies and will be removed from all danger of fumes from such materials.

g. Rope up to 2 inches in circumference will be wrapped in burlap or waterproof paper.

h. Rope will never be put into storage while wet or covered in a manner that will cause it to retain moisture.

i. Coverings will be left on the outside of rope coils; lashings will be cut from the inside of the eye leaving the covering intact.

j. Rope will be inspected to locate the inside end which is in the eye (opening in center of coil) when opening a coil; all stock should be taken from this end.

k. Before cutting rope, whipping of yarn should be applied on both sides of the proposed cut to prevent the strands from becoming unlayed.

l. Rope will be stored on reels, in bins or racks, or on pallets according to the quantity and size to be stored.

5–612. Wire Rope

a. Storage. Wire rope should be stored in a cool, dry place away from fumes, chemicals, heat, or dampness and should be kept on the reel or spool until used. If it is to be stored for a long period of time, the full length of the rope should be coated with a preservative (MIL–C–16173, grade 1). In the manufacture of wire rope, a lubricant is applied to the hemp center which acts as a storage medium for the oil. Wire rope should be kept away from all chemicals such as acids which attack the metal and alkali which will destroy the internal lubrication. Damage by chemicals is not always noticeable and the concealed weakness makes the cable dangerous to use.

b. Corrosion. Corrosion or rust weakens a rope but it is almost impossible to ascertain the loss in strength. Exterior loops of the rope should be examined frequently for signs of rust or corrosion.

c. *Unwinding.* When removing wire rope from a reel, the reel must be rotated on a spindle r ting on a cradle (fig. 5-48), or a turntable, or by oiling the reels along the floor. A surplus race from a gun mount may be used as a turntable (fig. 5–49). Wire rope should never be taken from one side of the reel as each wrap on the reel produces a kink in the rope which makes it unsafe for use. A short, angular bend, known as a “dog leg,” resulting from a partial kink will chafe on the flanges of the sheave and wear the rope prematurely at that spot.

d. *Cutting*. Before cutting any wire rope (including preformed rope), apply three seizings on each side of the proposed cut. If cutting is done by an acetylene torch the seizing can be omitted as the wires and strands will be welded together.

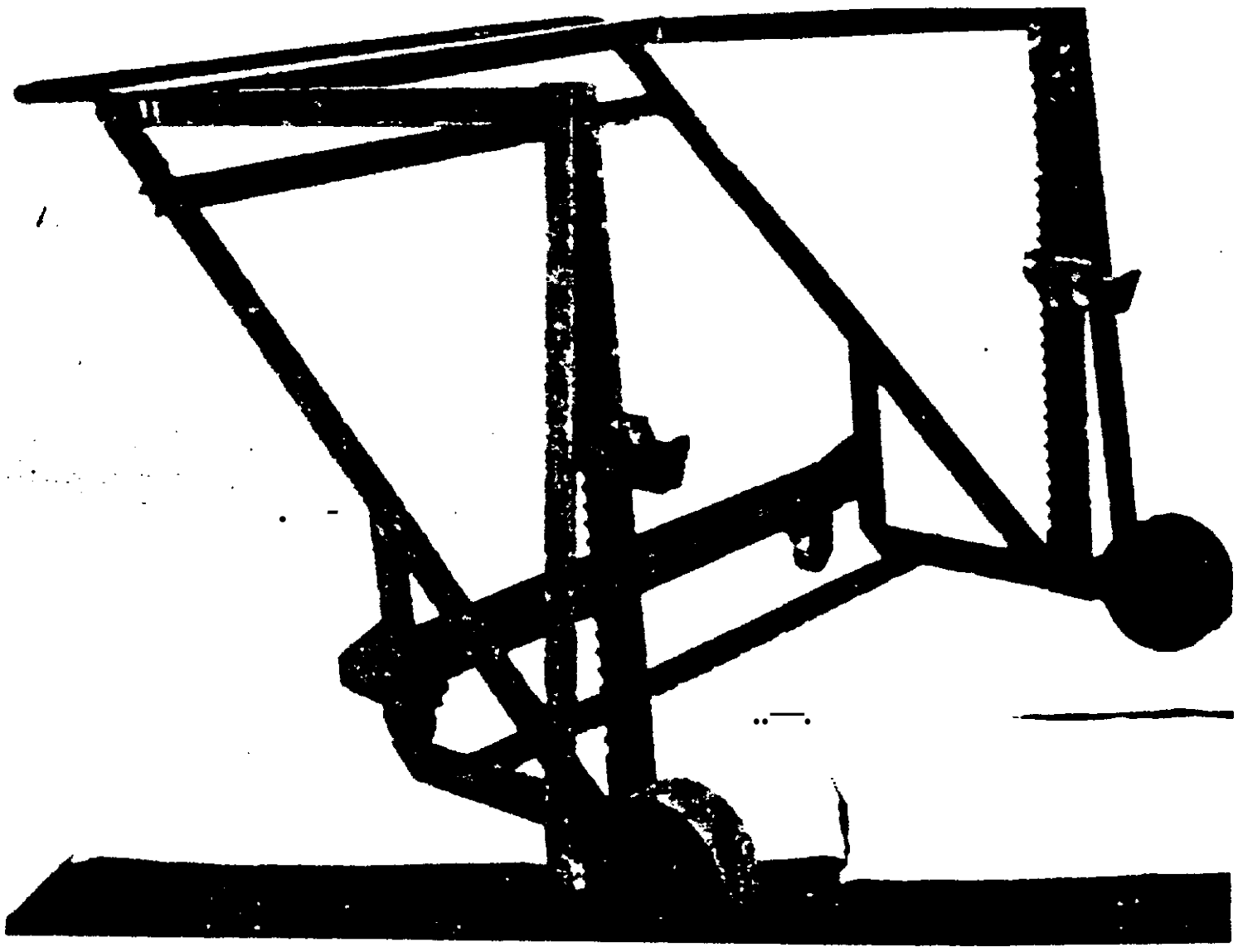

Figure 5-48. *Cradle for handling reels.*

Figure 5–49. Wire rope dispensing turntable.

5-613. Clay Targets

Clay targets are fragile items and the handler, always, will comply with the marking "this end up." Clay targets should be **palletized** and stored in storage racks or pallets and pallet support sets,

5-814. Cement

a. Cause of deterioration. Causes of deterioration of cement are as follows:

(1) Moisture.

(2) **Movement** or circulation of air.

(3) **Failure** to observe first-in-fret-out issue procedure.

(4) Warehouse pack (packing of lower sacks of cement when stacked too high for a long period of time).

b. Method of storage. Cement will be stored in dry covered storage areas. The circulation of air should be held to a minimum as air carries moisture. Cement will be stacked away from walls to avoid condensation or moisture.

c. *Pallet storage.* Cement will be **palletized** not to **exceed** four courses high per pallet. Pallet loads

will not be stacked more than two high unless aids are used to support the weight of superimposed pallet loads. Cement put into storage will not be disturbed until it is issued. Restacking or shifting (to avoid warehouse pack) exposes the cement to air circulation which increases the absorption of moisture.

5-615. Navigation Timepieces

a. *Security.* Timepieces should be stored in a room which, has adequate security facilities. This room should be located away from the shock and vibration of machinery; also should be air conditioned and free of dust.

b. Temperature. The controlled temperature should be maintained near 70° F. (+ 5“), with a relative hurnidit y of not more than 50 percent.

c. *Unpacking.* When received from the observatory, the timepieces should be unpacked, wound, uncorked or unlocked, started and set to Greenwich Central Time and given a 10-day run with daily winding and rating prior to storage. After the 10-day run, the timepieces should be allowed to run 48 hours more, then stopped and corked or locked, and stored,

d. Storage. When not running, all navigational timepieces should be inverted every 30 days to redistribute the oil on lubricated surfaces. When the timepieces have been in storage 6 months, and not more than 8 months, wind, start, and allow to run for 5 days with daily winding after the timepieces have operated for a period of 2 days, should be rated for 3 days. At the conclusion of this 5-day trial period, the timepieces should be stopped and returned to storage. Suitable shelving or cabinets should be provided for all timepieces.

5-616. Machine Tools and Production Equipment

a. Reference. Detailed information concerning the preparation of machine tools and similar equipment for extended storage will be found in MIL-STD-107 and in Joint Publication TM 38-260, NAVSUP Pub 523, AFR 71-18, MCO 4870.62, DLAM 4145.9, Preparation of Industrial Plant Equipment for Storage or Shipment.

b. General. Most machine tools are large, bulky, and heavy; this fact should be considered in laying out space. Large, unwieldy pieces of equipment and unusually heavy items should be stored as close to removal aisles as possible. Machine tools vary considerably in weight, shape, and size, but this does not mean that the tools can be placed haphazardly in the storage warehouse. Machine tools should be lined up by type and arranged so that adequate aisle space is provided, not only to facilitate inspection but also to provide easy removal without disturbing other units. This equipment can be block stacked, providing it is composed of similar units.

c. *Crating.* Most crating of machine tools is unnecessary and costly. Crating should be used only when the individual tool is adaptable for tiering. Tiering of machine tools should be limited to such tools with solid bases, rectangular columns, and circular pedestals. Only such tools weighing less than 10,000 pounds should be tiered. The use of bolts in place of nails for such crating is permissible. Consideration also should be given to floor load capacity and accessibility. Block stacking should be determined by qualified personnel at each activity (fig. 5–50).

d. Storage. The areas directly under craneways are to be utilized, so far as practicable, for the heaviest units. This is the most expensive storage space and will require a limited number of removal or access aisles, since the direction of storage is upward. In order to facilitate inspection and removal, units should be placed so that inspection and removal space is provided. The size of removal aisles will be governed by the size of the units, but should not exceed the width necessary to furnish convenient passage for handling equipment. Where practicable, the aisles should be continuous and provide straight movement (fig. 5-51). For space conservation, it may not always be practicable to store units immediately adjacent to removal aisles; in this event inspection aisles should be widened to provide enough space to move individual units through to the removal aisles. Steel rollers, overhead cranes, forklift trucks, dollies, lift jacks or other suitable handling equipment can be used to move any unit from storage, provided care is taken to determine the center of balance and position of pedestal and bases. In order not to disturb the protective coating and preservatives, the material should be moved only for inspections, in emergencies, or when ordered for issue. Platforms and racks should be used when within the limits of floor load capacities and available air rights. When a unit is moved, the nuts of all holddown bolts should be tightened securely.

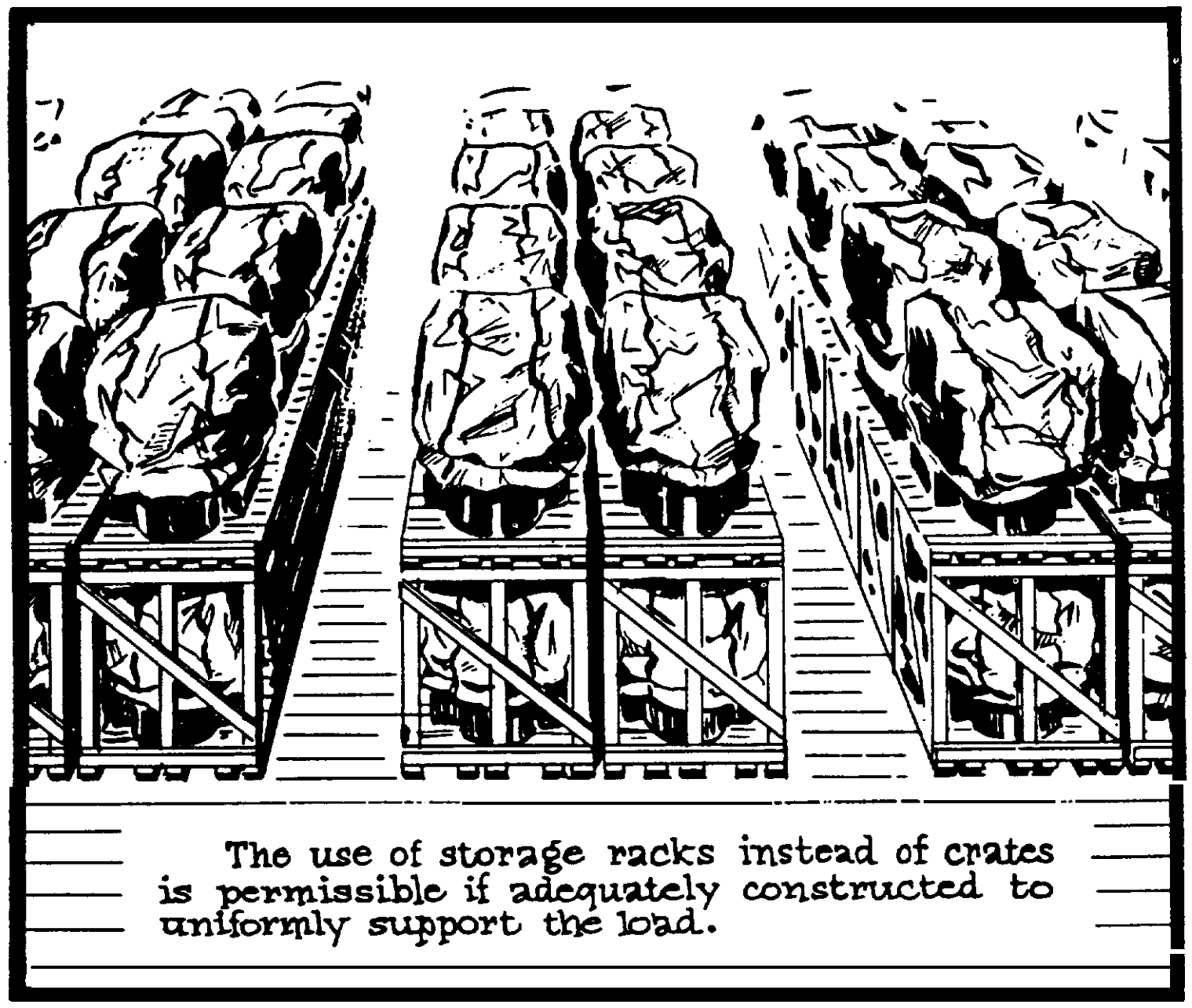

Figure **5-5o.** ***Tiering*** *of* ***machine*** *tools.*

e. Use of skids. All units should be skidded when stored to protect the machinery during handling. It is recommended that the skids remain attached to the machine while in storage. Guidance is provided in **MIL–HDBK–701.** However, at activities where leveling jacks are available and personnel are familiar with the storage of machine tools and production equipment, skids can be removed. When skids remain on the units, units should be leveled properly before storing. If the floor is too irregular to use shims, the skidded unit should be placed on wooden strips, 1 to 2 inches in thickness. To ensure proper distribution of weight and to maintain the unit level at all times, the strips should be placed at right angles directly under the bolt heads. The strips not only prevent the unit from warping and distorting, but also will protect the skids and facilitate movement of the units. In storage, the nuts will be backed off 1½ to 2 inches from the top of the skid. The bolts and nuts should be protected with a preservative. All machine tools in storage should be tagged with the following information (red tags preferably] "CAUTION: TIGHTEN ALL HOLDDOWN BOLTS BEFORE REMOVING THIS MACHINE FROM STORAGE."

f. Accessories. Accessories should be boxed or crated and placed on the skid or platform of the unit from which removed. Precautions should be taken so that the wood of the boxes or crates does not come in contact with the preserved machine surfaces. When it is not possible to place accessories on the skid, such accessories should be stored adjacent to, or in the vicinity of, the machine tool; proper identification should indicate clearly the unit to which the crated accessories belong.

g. *Tiering.* Where it is necessary to use tiering methods to conserve storage space, care should be taken in selecting machines to be tiered. Machines of long bed design, with leg type, end frame, or multiple column bases, or weighing more than 10,000 pounds should rest on a solid base and not be placed on top of other machines.

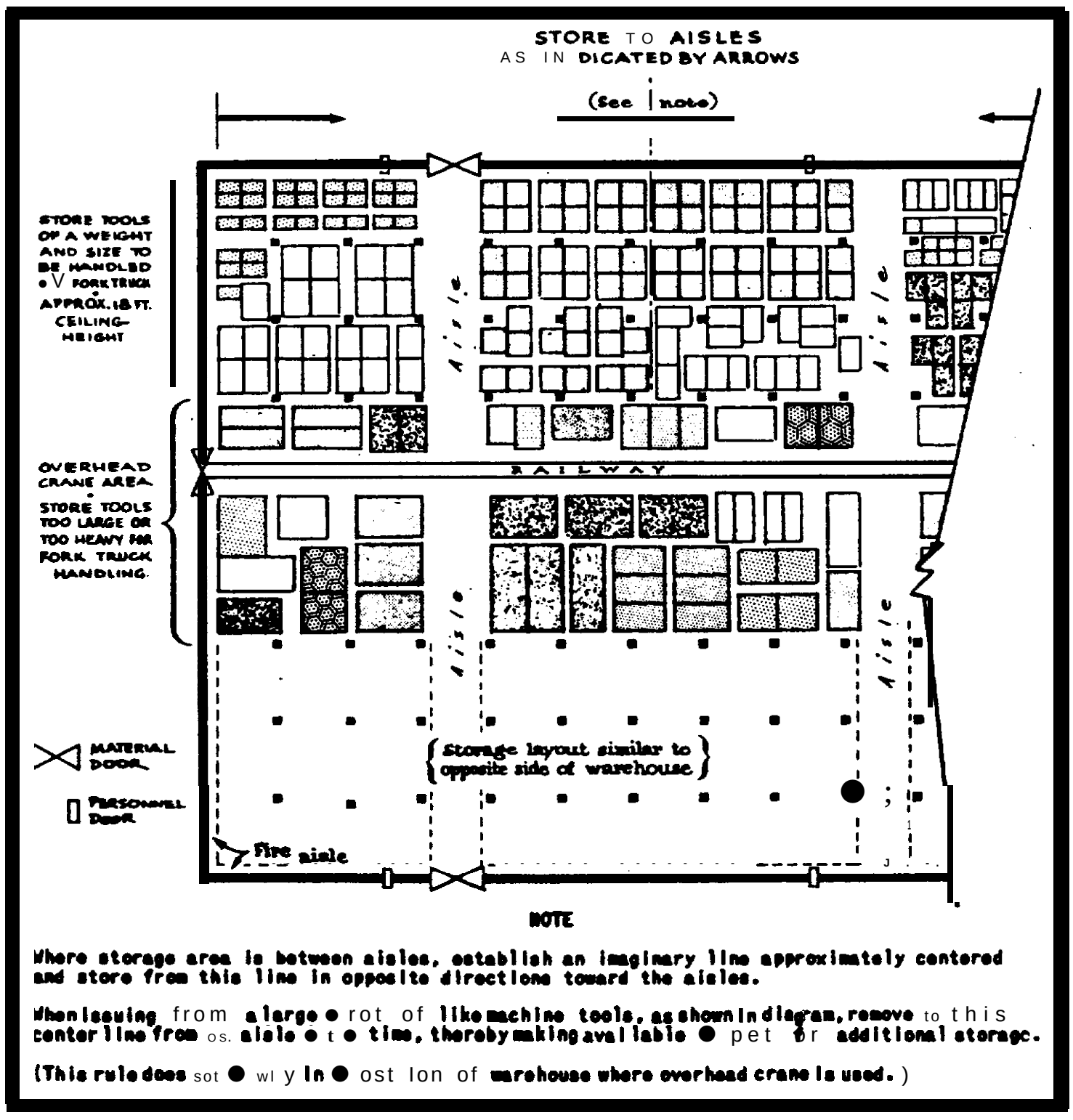

Figure 5–51. Typical storage layout of machine tools.

h. Machines weighing more than 10,000 pounds. Tiering of machines tools, such as lathes with long beds or other units with extended legs, long tables, or double columns may distort or warp the tools beyond reasonable repair. Small machines that have rectangular columns of circular pedestal bases can be tiered, provided suitable crating or dunnage is inserted between the machines to bear the load. To avoid permanent distortion of frame members by undue stresses or strains, all machines should be leveled and supported. Machine tools may be tiered two tiers high, but there are some types of industrial equipment that can be tiered higher when crated such as welders, furnaces, heat treatment equipment, and washing machines.

5-617. Tires, Tubes, and Rubber Products

a. Selection of warehouses. Warehouses in which tires are stored must provide the maximum safety and protection to the tires housed. Buildings used for tires storage should-

(1) Provide maximum protection against fire and reduce fire hazards to a minimum.

(2) Provide protection from light.

(3) provide a uniformly cool temperature.

(4) Be free of operating electrical equipment which generates ozone.

(5) Provide protection against drafts or air movement since air currents increase rubber deteriorating oxygen in the air and aid combustion in case of fire.

b. *Aircraft tires and tubes.*

(1) The age limits for aircraft tires and aircraft inner tubes are based on the date of manufacture. Retreaded tire age limits are also from the date of tire manufacture, not the date of retreading. Aircraft tire manufacturing dates are included in the serial number of tires. The serial number consists of a maximum of ten positions, alpha and/or numeric. The first four positions are the date of manufacture in the form of a Julian date (last digit of the year followed by the day of the year i.e., 23 May 1968 is written "8144).. Manufacturing dates shown previous to this method are identified by month and year (such as 10-68/October 1968). Inner tubes have the date applied to the tube by decal or stamped on the surface. The outside of the tube cartons are also date stamped. Proper control and rotation of stock procedures will be implemented to assure that the oldest age dated items are issued first. Color tape is used on aircraft tires manufactured in 1962 and subsequent years to aid in age identification of the tires while in storage at depots, storage sites, air bases, etc. Tires manufactured in 1962 and subsequent yeara are color coded with one circumferential band of l-inch wide tape, completely around and approximately centered on the tread. This paragraph is intended as information only, and is not used as authority to require tape markings of tires currently in storage. New tires will be color coded by the manufacturer before delivery.

*Tape Color Identification Data

Year	*Tape color*
1862	White
1963/1970	Silver or gray
1964/1971	Green
1965/1972	Blue
1966/1973	Orange
1867/1974	Yellow
1968/1975	Magenta
1869/1976	Red

*Tires manufactured after 1971 have the year printed on the following colored tape.

Year	*Tape Color*
1971/1974/1977	Green
1972/1975/1978	Blue
1973/1976/1979	Orange

(2) Serviceable aircraft tires will be placed into suitable tire racks so that tires will be held in a vertical position and with each tire holding its own weight only. The rack will provide a flat or covered surface for the tire rather than around surface such as pipe or tubing. If this procedure is not followed, particularly in the case of tubeless tires, it may be impossible to mount the tire without the aid of additional equipment. The flat spots on the tread which may develop from storing tires vertically are not harmful. Such flat spots will disappear when the tire is mounted and inflated.

(3) Reparable aircraft tires may be stored in a vertical or horizontal position. Flat spots caused by storage in either position are corrected during the retreading process. Tires stored in a horizontal position will not exceed the. stacking limits specified below.

(4) Reparable aircraft tires with a normal cross section width of 10 inches and above will not be stacked more than 10 tires high.

(5) Reparable aircraft tires with a normal cross section width of less than 10 inches will not be stacked more than 15 tires high.

(6) Aircraft inner tubes will be stored to avoid creasing. Innertubes will not be completely deflated and will be dusted with tire talc to prevent the tubes from sticking together. Whenever possible, innertubes will be packed in fiberboard boxes. If fiberboard boxes are not available, tubes will be wrapped in heavy paper and stored in a darkroom. Packages will be plainly marked to indicate contents and will state size, type of tube, date of manufacture, and stock number.

(7) Tires and tubes should not be stored in the vicinity of electrical discharges from the operation of electric motors, generators, welders or other electrical devices.

c. *Over the Toad and industrial vehicular tires and tubes.*

(1) The preferred method of storing pneumatic rubber tires, mounted and unmounted, tube and tubeless, new, used, and reconditioned, is in aver-tical position. Horizontal storage is not as satisfactory because of the necessity for reversing at 6-month intervals. However, where small quantities of tires are involved, horizontal stacking is economical. When horizontal pallet storage is used, the quantity of tires to be stacked on each pallet should not exceed the following limits.

Tire size	*Maximum number of tires to be stacked* one upon *another*
600 × 16	15 each
650 × 20	14 each
750 × 16	12 each

Tire size	Maximum number of tires to be stacked one upon another
700 x 20	12 each
900x16	8 each
1,000 x 20	6 each
1,200 x 24	6 each
1,300 x 20	6 each
1,400 x 20	5 each

If the indicated limit is exceeded, the bottom tire is in danger of permanent damage. This limit also applies to placing one pallet on top of another, when intervening supports are not provided between the pallets. If tires stored horizontally remain in storage for over 6 months, each stack should be reversed so that the bottom tire is on top.

(2) Vertical storage of tires eliminates the necessity for periodic rewarehousing which is required when tires are stored horizontally.

(a) Tires (tube or tubeless type) stored in a vertical position should be grouped by size on standard 40-by 48-inch pallets combined with appropriate size standard pallet support sets, to form a tire storage unit (fig. 5–52). As an alternate method, pallet racks may be used if they are more readily available. Suitable wood racks, steel racks or slotted-angle receptacles and nonstandard pallet support sets, now in use, are acceptable pending normal replacement action.

(*b*) Unmounted tube type tires may be stored in pyramidal fashion as depicted in figures 5–53 and 5-54. This method permits the attainment of adequate storage heights with a minimum requirement for storage aids. Tires elected to be stacked in pyramidal fashion should be bundled as follows:

1. Tire sizes 14 inches (OD) up to a size less than 26 inches OD should be bundled utilizing four evenly spaced %-inch x .020-inch, QQ–S–781, flat steel straps. The compression of the bundled load should amount to 15 percent of the bundled height. Compressed bundle of these sizes should not exceed 43 inches in height. When compressed bundles do not exceed 43 inches, two bundles will adequately fit (horizontally) side by side when shipment is by MILVAN or SEAVAN.

2. Tire sizes 26 inches OD up to 48 inches OD should be bundled utilizing four evenly spaced %-inch x .023-inch, QQ–S–781, flat steel straps. Compressed bundles of these sizes should also not exceed 43 inches in height.

9. As long as the tire bundles on the bottom layer are chocked with a 2 **x 4** or **4 x 4,** tires can be safely stacked four bundles high.

4. An exception to the above are tires size 11.00 x 15 which can by pyramidal stacked five bundles high (fig. 5-53). The fifth layer should be offset from front to rear to tie the stack of tires together to provide more stability to the block stack.

5. Tires can also be pyramidal stacked atop a base layer of tires stored in pallets and support sets as illustrated in figure 5-54. In addition to greater space utilization through achievement of higher stacking, this method provides better stack stability to the tires being stored.

6. Two or more tire sizes should not be piled in the same stack.

(*c*) Tires in storage can deteriorate in time to an unuseable state. Stock rotation is necessary in order to prevent such loss. To ensure maximum protection against loss from deterioration, a strict policy of issuing oldest stock first will be practiced. When tires or tubes are received for storage, the month and year of manufacture or retread will be indicated on the pallet placard. This will aid in selecting the oldest stock first.

(3) Care must be used at all times in handling of tires, tubes, and rubber products. They must not come in contact with gasoline, oil, or other petroleum products. (If such contact is unavoidable, wash immediately with vegetable oil, soap and water.) Cutting, scuffing, or scraping of tires during handling must be avoided.

(4) Unmounted tires and tubes must not be stored in the open. Where closed warehouses are not available for storage of unmounted tires, or where it is necessary to store tires mounted on vehicles in open storage for periods exceeding 90 days, pending removal to covered space, they should be protected in accordance with MIL-T-46755. Tires manufactured or reprocessed with anti-ozonant "02" compounds do not require additional protection until 2 years from date of manufacture.

Note. Date of manufacture and "OZ" marking are normally imprinted on the tire sidewall. Date of reprocessing is normally imprinted *on* a reconditioned tire sidewall.

(5) Used serviceable tires will not be placed in storage until they have been cleaned, inspected, and had all foreign material removed. Serviceable used tires, including those reconditioned, will be stored and handled the same as new tires.

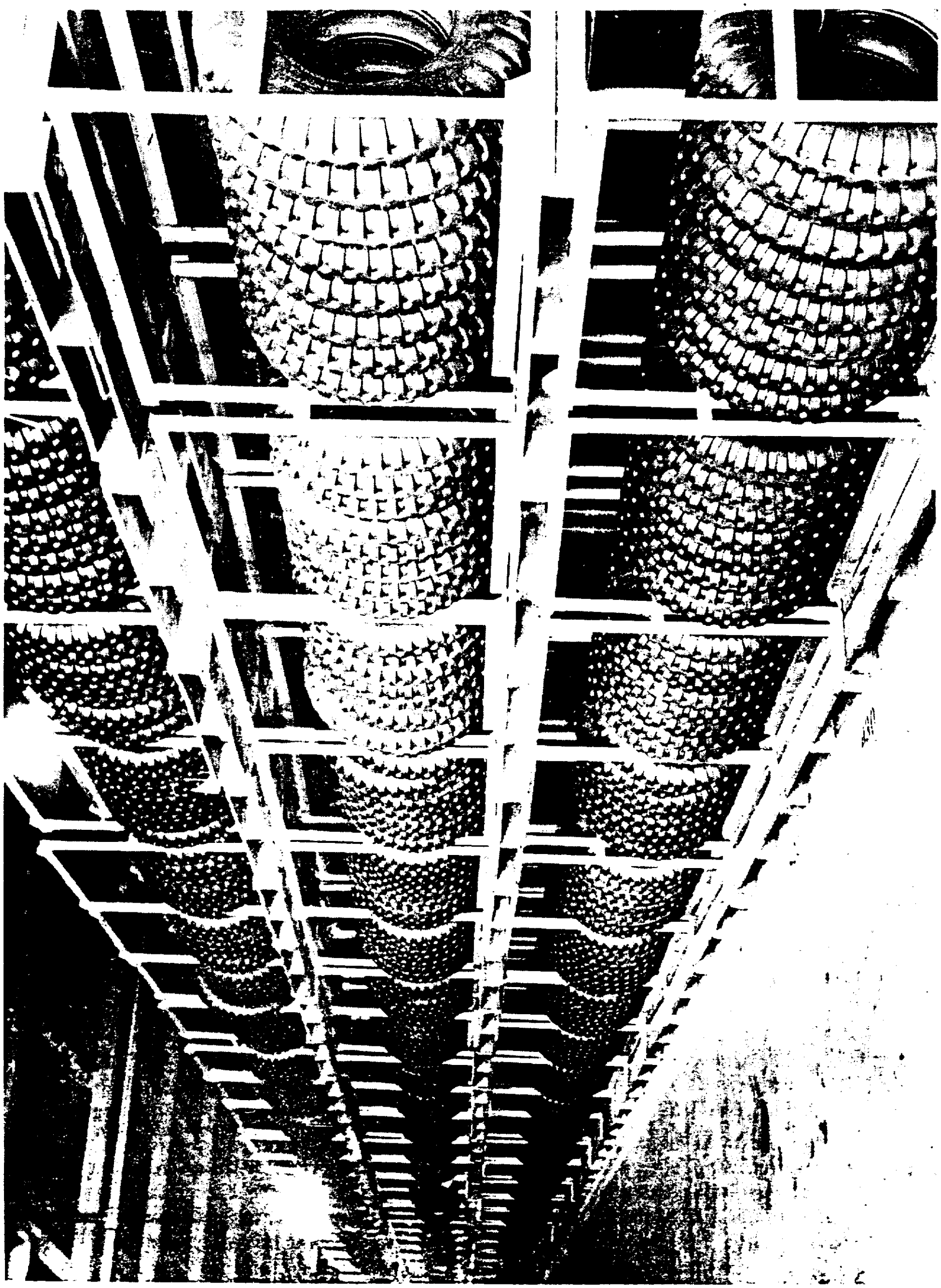

Figure 5–52. Typical storage in pallet support sets.

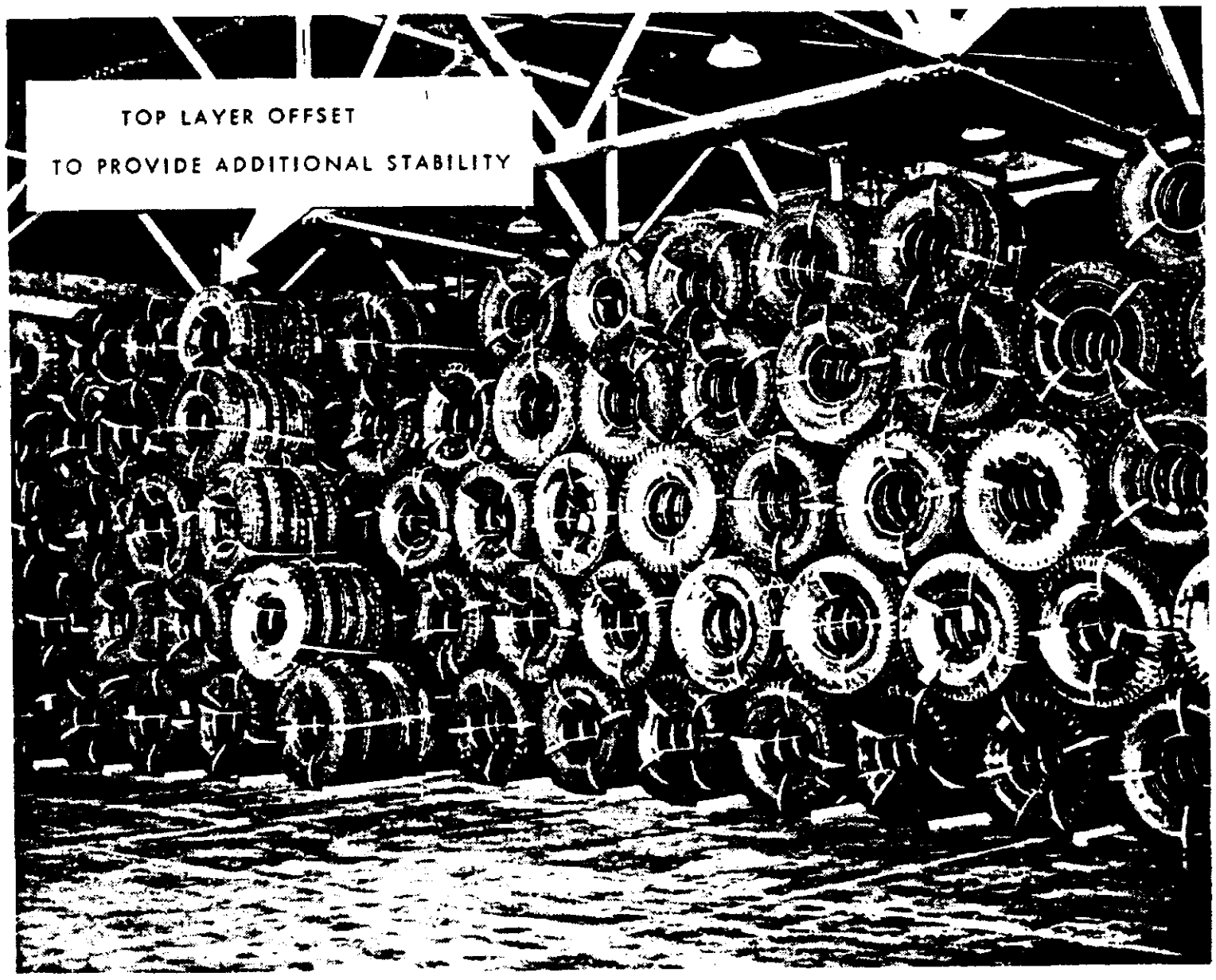

Figure 5-59. Block stack of ***11 .00x15 tires.***

(6) Tubes must be handled with care equal to that given to tires.

(a) New tubes should be stored in the original package and protected as outlined for tires.

(*b*) Used serviceable tubes should be completely deflated by removing the valve core. They can be folded and stored.

(c) Tubes will be placed in storage grouped according to size and type. Removal from storage will be on the basis of oldest stock first.

(*d*) Self-sealing tubes must be inflated enough to retain full molded size. Storage aids (e.g., pallet support sets) will be used to assure retention of shape and size.

d. Solid rubber tires and track components. Solid rubber tires, rubber components of combat vehicle track, track support rollers, and track idler wheels will be protected as outlined in *c* above.

e. *Rubber cements.* Rubber cements must be kept within 32° to 90° F. and all containers must be kept tightly closed at all times. Rubber cements, dependent upon flash point, are either flammable liquids or combustible liquids and must be considered for storage in light of their flammability properties.

5-618. Abrasive or Grinding Wheels

a. *General.* All grinding wheels are fragile, and should be handled and stored carefully to prevent breakage and chipping.

b. Location. Wheels should be stored in covered, dry areas, and should not be exposed to extreme temperature changes. Escaping steam and rain will seriously affect grinding wheels, consequently, such wheels should be away from radiators and open windows.

c. Storage. Generally, grinding wheels are stored in bins and racks. Smaller sizes are often carried in bin drawers. The bins, racks, or drawers should be built to accommodate wheels of various sizes. Separate sections of storage racks should be constructed within standard shelving to prevent the wheels from rolling off (fig. 5–55). Wheels of the

Figure 5–54. Tires stacked atop a base layer of pallets and support sets. Note the 6-inch extension on the support set uprights.

me size, type, and specification should be stored ogether and should be arranged, so far as possible, o facilitate issue on the basis of first in, first out (fig. 5-56).

d. Straight and tapered wheels. Most straight and tapered wheels should be stored on edge in racks. The racks should provide two point cradle support for the wheels to prevent rolling. A sufficient number of partitions to prevent wheels from tipping over should be provided. An individual section is recommended for each wheel of unusual shape.

e. *Thin organic bonded wheels.* Thin organic bonded wheels should be stored on a flat surface away from excessive heat. A heavy steel plate or thick vitrified wheel makes a good foundation for stacking, and similar plate or wheel placed on the top of the stack will help prevent warpage.

f. Cylinder, *cup, and saucer wheels.* Cylinder wheels and large straight cup wheels can be stacked on the flat side with corrugated paper or other cushioning material between the wheels, or can be stored in racks similar to the racks used for storing straight wheels. Large flaring cup wheels should be placed flat on a horizontal shelf, alternating the position so wheels are stacked base against base and face against face. Small saucer, cup, and dish wheels, without thin, easily damaged edges or rims, can be stored on edge.

g. *Cloth-backed thin discs.* Cloth-backed thin discs should be supported and weighted the same

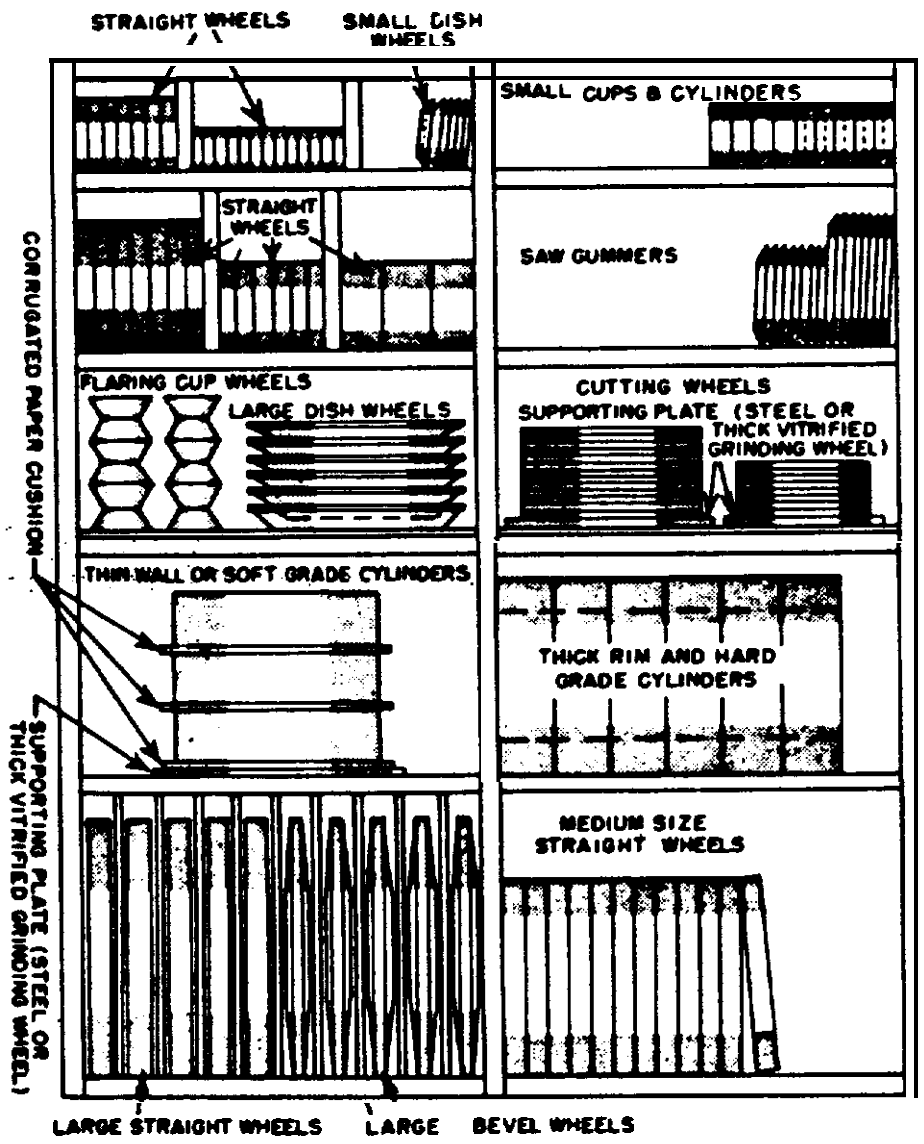

Figure 5-55. Bin storage of grinding wheels.

as bonded wheels, and should be stacked cloth to cloth and grain to grain to avoid damage to the cloth backing. Also, this method of stacking will help to prevent warpage.

h. Small shaped wheels, Small shaped wheels, such as plugs and cones, should be stored in boxes, bins, or drawers.

5–619. Glass

a. Storage. The relative humidity in glass storage areas should not exceed 65 to 70 percent, because moisture and dampness have a tendency to etch glass when it is stored for long periods of time. Glass should be stored in original containers until ready for issue. If glass is removed from original containers, the three types of storage racks generally used for storage are the "A" type, pocket type, and slotted type. Because of its fragility, glass should be handled with extreme care. Persons handling large sheets of glass should use rubber grips or pads.

b. Small size glass. Window glass and other small size glass should be stored in pocket type storage racks if removed from original containers. If pos-

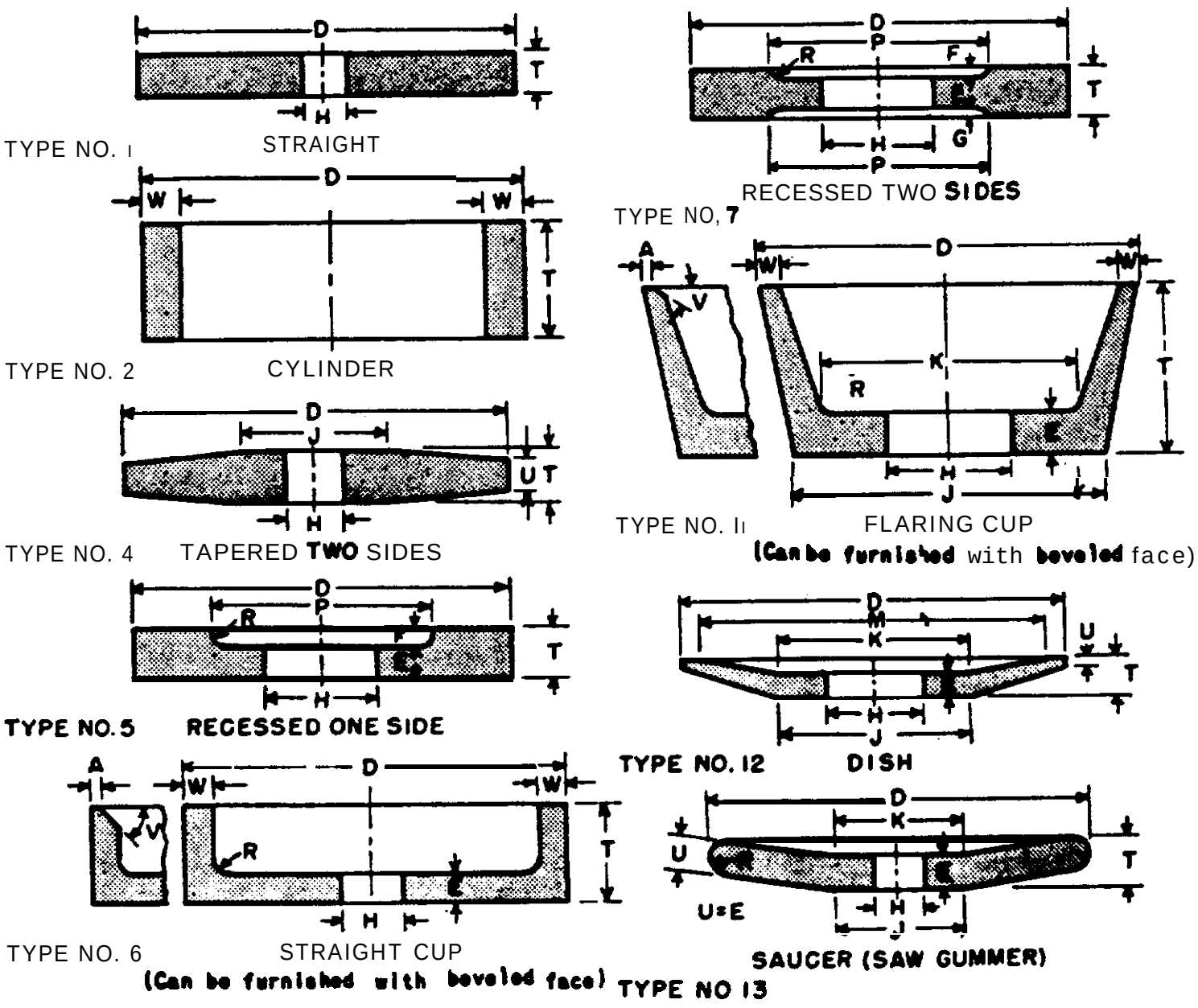

Figure 5-56. Typical types of grinding wheels.

sible, the racks should be constructed from redwood because this lumber is free from knots and gives added protection to the edges of the glass. Glass stored in pocket racks should have an absorbent type of paper, between each sheet of glass. Bulk storage of small size will be palletized if the quantity is large enough.

c. *Plate glass*. Medium size plate glass, if removed from original containers, should be stored in slotted type storage racks. The slotted rack should be constructed from stock lumber with the slots made of maple, if available. The maple should be three-eights of an inch milled and three-eights of an inch routed to form the slots, and the separators at the top of the racks should be constructed of various thickness of masonite. Plate glass in original containers should be stored on edge.

d. *Extra large* sizes. Glass of extra large or special sizes should be stored on "A" type racks.

e. *Handling block.* A wedge-shaped handling block is used for handling plate and large size sheets of glass. This wedge-shaped block is constructed from stock lumber and is covered with carpet. The carpet protects the edge of the glass and permits easy removal from the racks.

5-620. Miscellaneous Chemicals

a. *Handling precautions.* Although some chemicals are not hazardous materials, a certain amount of care is required in storage and shipment. All chemicals should be placed in containers that will prevent breakage during transit. Before making shipments of any chemicals, the sending activity should consult Interstate Commerce Commission regulations to determine whether special requirements are necessary.

b. Example chemicals requiring special considerations for storage and shipment.

(1) *Aluminum chloride (anhydrous).* Aluminum chloride should be stored in airtight drums or sealed glass containers. Exposure to moisture or air makes it unfit for most uses. Packs should be examined frequently to make certain that the airtight seal is in perfect condition. It is nonexplosive and not a fire hazard.

(2) *Antimony sulfide.* Antimony sulfide should be stored in tight barrels, steel drums, kegs, multiwall sacks, or boxes. If necessary, the containers should be lined with paper to prevent leakage. Antimony sulfide should be stored away from corrosive fumes and kept dry. It is not a fire hazard.

(3) *Boric acid.* Boric acid should be stored in a dry place, in wooden barrels, multiwall sacks, kegs, boxes, or burlap bags. It is nonexplosive and not a fire hazard. Containers should be lined to prevent leakage.

(4) *Calcium chloride (anhydrous).* Calcium chloride should be stored in sealed steel drums, cans, or jars. Because it absorbs water, it should be kept away from air and moisture.

(5) *Copper oxide.* Copper oxide should be stored in wooden barrels, kegs, fiber drums, multiwall sacks, or boxes, and should be kept dry. It is not a fire hazard.

(6) *Dextrin.* Dextrin should be stored in wooden barrels, fiber drums, multiwall sacks, kegs, boxes, or bags, and should be kept dry. It is not a fire hazard.

(7) *Iron (reduced).* Reduced iron should be stored in sealed cans and bottles and should not be exposed to air and moisture.

(8) *Kaolin.* Kaolin should be stored in wooden barrels, kegs, boxes, or bags, and should be kept dry.

(9) *Lime (hydrated).* Lime should be stored in tight barrels or multiwall sacks and should be kept dry.

(10) *Potassium iodide.* Potassium iodide should be stored in barrels, kegs, bottles, or boxes in a dry area.

(11) *Silica gel.* Silica gel should be stored in sealed water and airtight drums, pails, and cans, and should be kept dry. It is not a fire hazard.

(12) Sodu lime. Soda lime should be stored in airtight glass or metal containers and should not be exposed to air or moisture.

(13) *Sodium bichromate.* Sodium bichromate should be stored in barrels, kegs, multiwall sacks, or boxes. It is an oxidizing material and should be stored away from acids and combustible materials. Containers should be lined to prevent leakage.

(14) *Sodium bisulfite.* Sodium bisulfite should be stored in barrels, drums, kegs, or boxes and should be kept dry. Containers should be lined to prevent leakage.

(15) *Sodium hypochlorite (solid).* Sodium hypochlorite is unstable in the air and should be stored in a solution in carboys or bottles and kept in a cool place.

(16) *Sodium hyposulfite.* Sodium hyposulfite should be stored in wooden barrels, kegs, metal drums, multiwall sacks, or boxes in a dry area.

Containers should be lined to prevent leakage. It is not a fire hazard.

5–621. Musical Instruments

a. Woodwinds and brass. The following instructions pertain to the storage of woodwinds and brass instruments:

(1) Instruments should be kept in cases when in storage.

. . (2) Each case should. contain a l-ounce block of camphor to reduce humidity, prevent tarnish, and act as a" moth "repellent for the plush lining of the case.

(3) Instruments should be inspected, cleaned, and repaired, if necessary, before being placed in storage.

(4) Woodwinds and brass should never be stored in damp areas or in extreme heat as heat and dampness cause corrosion and tarnish.

(5) Woodwinds should be oiled twice yearly while in storage; bore oil is preferred.

(6) A desirable temperature for woodwinds and brass is between 65° and 75° F.

(7) Small instruments should be packed in containers and palletized.

(8) Large instruments should be packed in containers and crated with a skeleton frame strong enough to sustain the weight of stacking.

b, String instruments. The following instructions pertain to the storage of string instruments:

(1) String instruments should be kept in carrying cases, with a l-ounce block of camphor to reduce humidity.

(2) String tension should be released before the instruments are placed in storage. Sound posts must not be allowed to become loose.

(3) Before being placed in storage, instruments should be cleaned, inspected, and repaired, if necessary.

(4) A desirable temperature for the storage of string instruments is between 65° and 70° F. Temperature should be kept as constant as possible.

(5) Open containers of water should be kept near large string instruments, such as the violin, cello, and brass.

(6) Bass violins and violin cellos should be suspended in art upright position while in storage, with the bottoms of the instruments fastened to prevent swinging and bumping each other.

(7) Small string instruments should be packed in containers and palletized or placed in bins or racks, depending on the quantity to be stored.

c. Drums. When storing drums the following precautions should be observed:

(1) Drums should be kept in cases while in storage.

(2) Tension on drum heads should be released before drums are placed in storage.

(3) A desirable temperature for the storage of drums is between 65° and 70° F.

(4) Drums should be packed in containers and palletized.

d. Pianos. Excessive heat and dampness can damage a piano in a very short time. A temperature variance of 18° F is the maximum permitted in areas where pianos are stored. Pianos can be stored in nonheated warehouses, but should not be placed near an open window or in extremely dry spaces because of the large amount of glue used in the case and action. If a piano is not stored at a constant temperature of 68° F, a small package of unslacked lime should be put inside the case to prevent rusting of the strings. The heat from a lighted 15-watt light bulb attached to the base of a keyboard instrument will act as a dehumidifier. Because of the large amount of felt in a piano, it is recommended that a suitable moth repellent be kept in the case at all times. For long term storage, grand pianos will be stored flat.

e. *Instrument accessories*. Generally, accessories are bin storage items. Reeds should not be stored in dry, overheated places that will cause the reeds to split, crack, or lose the vibrating qualities. Also, reeds have a tendency to mold or mildew when exposed to air. Gut should be stored in a refrigerated unit with a quart of water containing 2 teaspoonful of formaldehyde placed near by.

5-622. Strategic and Critical Materials

See Chapter VI.

5-623. Brushes; Feather, Wool, Bristle, and Hair

a. General. The two hazards encountered in the storage of brushes manufactured from keratinous materials such as feathers, wool, bristle, and hair, are—infestation of the brush by various beetles, mold or mildew and rot due to humid atmospheric conditions.

(1) *Beetle infestation.* Four types of beetles which cause damage to the keratinous part of the brush are commonly known as the black carpet bee-

tie, the furniture beetle, the varied carpet beetle, and the buffalo or moth beetle. (See figs. 3-10,3-11 and 312, chap. III, sec 4.) There is also the lyctus powder post beetle which attacks all types of hardwoods generally used for handles.

(2) *Climatic hazards*. During long term storage in humid climates, the keratinous part of the brush may develop mildew, mold, or rot.

b. Precautions prior to storage. Usually, Federal specifications require manufacturers to enclose insect repellent 'with brushes; normally, this is accomplished by placing naphthalene balls in each pack or container. Receipts that have not been afforded the necessary protection will be inspected for infestation, and, subsequently, properly packaged for storage. Particular attention should be given to rollback, salvage, or surplus stock.

c. *Precautions in storage.* Brushes made of keratinous materials will always be protected from infestation by including naphthalene flake or balls or paradichlorobenzene flake or powder in each pack. Since these repellents tend to evaporate, care should be taken to replenish as required.

(1) *Bulk lot storage.* Bulk lots will be stored in original containers; if material is repackaged locally, a small amount of repellent should be added to each container which should be kept sealed.

(2) *Bin storage.* Brushes stored in bin boxes or openings should be kept in the unit pack. When the size of the smallest unit pack precludes shelf or bin storage, bin stocks may be placed in a protective wrap with a small amount of repellent.

(3) *Controlled humidity or temperature.* To prevent mildew, mold, or rot, especially in high humidity areas, material should be stored in controlled humidity or temperature storehouses.

(4) *Inspection of material in storage.* Sample quantities of stocks should be regularly inspected for signs of insect infestation, mildew, mold, and rot. The frequency and scope of these inspections should be established by the military service/agency concerned and should be predicated on local conditions.

(5) *Housekeeping.* Good housekeeping is the best additional preventive measure to be taken against infestation.

(6) *Safety.* Contact with insect repellent such as naphthalene and paradichlorobenzene can cause skin irritations. The fumes thereof, in heavy concentrations, are toxic. Personnel concerned will take the necessary precautions such as the use of goggles, rubber gloves, and half mask respirators. Conditions permitting, storage areas should be well-ventilated.

(7) *Damaged stock.* Material found to be damaged by infestation, mildew, mold, or rot should be disposed of in accordance with procedures set forth by the service /agency concerned.

5-624. Flight Clothing

a, Preparation of clothing for storage.

(1) *Inspection of new material.* All containers will be visually inspected for shipping and/or water damage. Damaged containers will be opened and the clothing inspected. All damaged or mildewed clothing will be reconditioned in accordance with applicable instructions.

(2) *Cleaning and reconditioning.* All clothing which has been worn will be cleaned and reconditioned by appropriate procedure specified in applicable specifications prior to storage for reissue.

b. Marking. The garments will be examined to determine that the proper identification markings are not missing and are legible. Where markings are not legible or are missing, markings as required by the applicable specification for the garment will be added. Markings not required by the applicable specification will be removed and obliterated in such a manner as to not adversely affect the garment's appearance.

c. *Storage*

(1) Precautions. Shelves, racks, bins, and all storage aids will be free from protruding nails, sharp slivers of wood, rough edges, burrs, or other defects that might tear or puncture any part of the clothing or which might chafe the surfaces. The storage area will be maintained free of rodents, insects, plant life, or other damaging influences.

(2) Storage *arrangements.* Oil, grease and dirt will be removed from rubber surfaces with a solution of vegetable soap and water. Omnienvironment full pressure suits are" issued with a carrying case and should be received packed in this original container. The anti-G, antiexposure, and omnienvironment full pressure suits will be stored on hangers with the items hanging free. The antiblackout suit bladder will not be folded. Carrying cases should be stored in an area adjacent to the suits whenever possible. Summer and winter flying suits and other flight clothing will be stored in their original containers, if received. Otherwise these items will be stored in bins, shelves, or on hangers as applicable. .""

d. Storage conditions.

(1) *Killing* larvae. If clothing is suspected of containing moth larvae, the larvae can be killed either by fumigation or reduction of the clothing temperature to 17° F, for a period of 36 hours. Fumigation is considered the more practicable method since it would be necessary to spread out each garment in order to reduce the garment temperature to the required 17° F.

(2) *Storage temperature.* All flight clothing should be stored at a temperature not greater than 42° F.

(3) *Storage humidity.* All flight clothing should be stored at a relative humidity of between 35 and 50 percent,

(4) *Atmosphere.* The storage area will be protected at all times from direct sunlight, and the atmosphere should be free from sulphur dioxide, ammonia fumes, and from ozone produced by electrical equipment.

(5) *Paradichlorobenzene crystals.* Paradichlorobenzene crystals will be kept in open containers in the storage room. If these crystals are used for packaging purposes, asphalt laminated paper will not be used inasmuch as the asphalt is soluble in the vapor and will cause bleeding on the articles packed.

(6) *Leather.* Leather flight gear will be inspected for mildew and deterioration. It will be treated periodically with suitable leather preservative. Store in cool dry area.

5-625. Polyvinyl Chloride (PVC) Plastic Pipe

Although polyvinyl chloride (PVC) plastic pipe will withstand some abusive handling conditions, there are limits. Establishing the limits is a subjective process since the physical properties of PVC compounds cover a rather broad range. In addition, some of the properties are affected by temperature. The following are basic precautions and care guidances for handling and storing this commodity.

a. Loading PVC Pipe

(1) Care should be used when loading and unloading PVC pipe with mechanical equipment such as forklifts. Dragging or jamming by said equipment can and will damage the pipe.

(2) Bundles of pipe should be loaded in such a manner as to prevent unnecessary loads on the lower bundles.

(3) When nesting PVC pipe, chicken wire, plywood or other suitable material should be used to keep the pipe within the pipe from sliding out during shipping. It is recommended that heavy wall pipe not be nested in thin wall pipe. Pipe should be free of dirt or caked mud since this can cause excessive scratching and abrading as the pipe is nested or denested.

(4) Straps or ropes should be used to tie loads down. Chains and binders that could gouge the pipe should be avoided. If chains and binder cable are used, adequate protection should be used where possible damage may occur, e.g. on edges, etc.

(5) Large diameter pipe should be loaded on top. This will allow tighter cinching of pipe, keep the pipe from crushing and prevent bundles from shifting. When the lengths vary, the shorter lengths should be on top.

(6) To prevent shifting that may occur during shipping, interbanding of the bundles in the load is recommended. This requires banding the top half of the load and the bottom half of the load into two modules then banding the top and bottom modules together. Alternately, separate bundles may be laid side by side and then secured to the bed by straps.

(7) Pipe lengths should not overhang the truck bed more than two feet.

(8) Extra care should be used in handling PVC pipe as the temperature drops below freezing since flexibility and impact resistance decrease with lower temperatures. Also moisture that accumulates on the pipe freezes, creating a slippery surface and enhancing the chances of the pipe sliding off fork lifts or shifting on the truck. (Refer to para g(6)).

(9) Pipe may be distorted if stacked too high or heavily loaded when temperatures exceed 100° F.

(10) Adequate protection should be provided so that PVC pipe will not be exposed to engine exhaust.

b. Receiving and Handling PVC Pipe

(1) *Inspection.* Each pipe shipment should be carefully inspected on its arrival. Pipe should be examined for cuts, scratches, gouges, holes and other imperfections before use. Any imperfections in the pipe that will adversely affect serviceability should be cause for rejection.

(2) *Unloading Precautions.*

(a) The same precautions observed when loading pipe should also be observed while unloading.

(b) PVC pipe may be unloaded from trucks by sliding over other plastic pipes, but care should

be taken not to slide the pipe over rough or abrasive surfaces.

(c) PVC pipe should not be dropped or thrown off a truck nor should the ends of the pipe be allowed to dig into the ground after sliding off a truck.

c. Storage,

(1) Pipe stored outside for long periods of time should be covered to protect it from prolonged exposure to. direct or reflected sunlight. The cover may be canvas or an 'opaque material as long as adequate air circulation is provided under the cover to avoid overheating.

(2) Pipe stored on uneven surfaces may, in time assume the contour of this uneven surface. This is accelerated by the weight of the stack and/or by temperature above 100° F.

(3) PVC pipe at the bottom of a stack may become out-of-round due to the weight of the material above. At moderate temperatures this corrects itself soon after the load is removed while at low temperatures several hours may be required for recovery. Caution: Long times or heavy loads may cause permanent out-of-roundness.

(4) Bundles of PVC pipe should have the belled ends or couplings alternated at each end of the bundle and extended beyond the other pipe ends. Alternately, bundles may be constructed in any manner that does not stress the bells and couplings.

(5) Store single lengths of PVC pipe on a flat surface so as to support the barrel evenly. If the pipe is to be placed in racks, support the pipe at least every three feet. Contact areas should be padded to prevent abrasive damage.

(6) Keep PVC pipe away from hot objects, pipelines, heaters, etc.

d. Loading Transfer Trucks.

(1) Use trucks with long bodies making certain the truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could cause damage.

(2) The first layer should allow couplings and belled ends to overhang the bed with each successive layer overhanging the layer below. Alternately, bundles may be constructed in any manner that does not stress the bells and couplings.

(3) Short body trucks maybe used if fitted with racks that properly support the pipe in a horizontal position.

5-626. Radioactive Material

Many commodities employed by the Federal services incorporate a radioisotope (ionizing radiation) as a functional component. Since ionizing radiation presents a significant potential hazard, rigid controls are imposed on handling and storage of radioactive material by Title 10, Code of Federal Regulations. These controls are stated in a general way in DLAM 4145.8/AR 700-64/NAVSUPINST 4000.34/AFM 67-8/MCO P44OO.1O5A Radioactive Commodities in the DOD Supply System and in OSHA 1910.96.

Section 7. PACKAGED PETROLEUM PRODUCTS

5-701. General

a. The storage of packaged petroleum fuels and lubricants (not including special fuel combinations or guided missile propellants unless specifically classified in this category) in standard containers involves nearly all the fire hazards encountered in the final use. In recognition of these inherent hazards, minimum safeguards must be established to avoid serious fires.

b. The procedures and instructions for the storage of packaged petroleum products are contained in MIL HDBK-201, Petroleum Operations.

c. Special markings of packaged petroleum products are conatined in MIL STD–290, Packaging, Packing, and Marking of Petroleum and Related Products.

d. Application of the appropriate storage principles set forth herein is a responsibility of the installation commander. It is recognized that under certain local conditions strict adherence to the prescribed storage practices will not be practicable. The following factors will be evaluated by the installation commander in consultation with petroleum, safety and fire prevention specialists before deviation from the prescribed practices is authorized:

(1) Type of product stored.
(2) cost.
(3) Type and condition of drums.
(4) Availability of storage space and handling equipment.
(5) Terrain features.
(6) Climate.
(7) Proximity and type of structures, source of ignition.
(8) Other pertinent information.

5-702. Use of Drums

a. As a general policy, storage of filled drums should be held to the absolute minimum needed to meet ordinary requirements. When bulk facilities are available, it is safer and more economical to store empty drums (see para 5–707), provide adequate drum-filling equipment, and store only enough filled drums to meet immediate requirements while the filling plant is in process of reaching full capacity, then to store large quantities of filled drums. Quality surveillance of product is more easily maintained in bulk quantities.

b. The practices covered below apply to large amounts of drummed products stored outside buildings, not to the storage of station supplies presently accommodated in standard flammable storage warehouses with the proper installed fire protection equipment.

5-703. Location

A level site should be selected that is not in or adjacent to a congested area, with the contour of terrain being such that an immediate runoff of surface water is possible through a system of open ditches. DRAINAGE INTO ANY SEWER SYSTEM IS PROHIBITED. An area with a cinder base, marsh, or wasteland overlaid with peat and usually more or less wet will not be used when other terrain is available. Consideration will also be given to direction of flow with the main outlets so located that flow is away from a congested area and toward a harmless area where fire extinguishing agents *can be* applied en route or at destination. An adequate supply of water for fire fighting purposes should be taken into consideration in the selection of this site. The drum storage area should be located or arranged so that escaping flammable vapors normally flow away from operational areas and sources of ignition. Depressed areas should be avoided because hazardous vapors tend to remain in them. Gasoline vapors are heavier-than-air, and tend to lie in a stratum less than 4 feet above grade and flow toward lower ground much as liquid flows to a lower level.

5-704. **Standards for Storage of 55-Gallon Drummed Petroleum Products**

a. *General.* The fire hazard involved in the storage of petroleum products is dependent, to a great degree, upon the flash point (see pars 5-404 and chap. 2, MIL HDBK–201) of the product and to the gross amount stored.

b. Covered Storage. Covered storage will be as outlined in chapter II of this regulation.

c. Outdoor *Storage.*

(1) *Stacking.*

(a) The drums will be placed horizontally (on sides) in double rows, but to butt, with closures (bungs and vents) facing outward. Drum closures should be placed at the 3 and 9 o'clock positions to ensure product inside drum will keep gaskets from drying out. If stored on ends, the drums collect rain water, which rusts the tops of the containers and may seep through and contaminate contents. Corrosion and oxidation are also greatly diminished by laying drums on their sides. The closures are turned outward to facilitate the detection of leaks and prevent a leaky drum being shipped.

(b) Spacing of rows is necessary to permit efficient operation of drum handling attachments, or inspection of drums such as butts and chimes. Spacing will conform to table 3 of chapter V section 4. Areas of high humidity and salty atmosphere accelerate corrosion, and drums stored in such areas will require more frequent inspection than low humidity areas.

(c) For low flash products the rows of drums

will not be more than 35 drums long. The drums of each superimposed tier of drums will be nested between drums of the supporting tier. The second tier will contain 34 drums and the third tier 33 drums; thus, the double row, or unit, will contain a total of 204 drums.

(d) For high flash products the quantity of drums in a major storage division can be doubled either by increasing the number of sections or the height of the stack to six.

(e) To ensure drums against damage from rolling, cross blocking every fifth drum will be required and,' in addition, the ends of the bottom tiers will be braced.

(f) The bottom tier of drums will be placed on not less than 2 by 6 inches of lumber or other comparable dunnage running parallel to the length of the rows.

(2) *Palletized stacking.* Occasionally drums may be placed on special drum pallets, which allow four 55-gallon drums to be placed on their sides on each pallet. Pallets will be constructed to prevent drums from rolling. Stack pallets one over the other with drum closures toward aisles. No end braces are necessary for palletized stacks.

(3) *Aisles.* Aisles should be provided so that no container is more than 12 feet from an aisle. Main aisles shall be at least 8 feet wide and side aisles at least 4 feet wide (OSHA 1910.106).

(4) *Physical layout.* The physical layout of the storage area within the limitations specified in this section will be as prescribed by chapter HI, section 3, this regulation.

(5) *Dikes (berms).*

(a) A recommended procedure for a major storage area containing products with a flash point of 80° F or below is to surround such an area by a dike at least 18 inches high, assuming the terrain to be practically level. This will prevent burning liquids from flowing to adjacent divisions, buildings, storage areas, or waterways. In any case, the dikes should be sufficient to retain all of the liquid contents of drums stored in the division and provide for a free board of not less than 6 inches.

(b) Access roads will be provided with ramps or graded to allow entrance of materials handling equipment into the diked area.

(c) Drainage will be accomplished by use of clay or metal pipe of sufficient size placed through the dike at the lowest point to ensure an immediate runoff of surface water. The aperture will remain closed except when it is necessary to remove surface water.

5–705. Standards for Storage of 5-Gallon Military Gasoline Containers (Blitz)

a. General. Observe the following precautions when storing filled containers:

(1) Inspect all containers for leakage. If a container shows evidence of leaking, transfer contents to another suitable container, taking all precautions to prevent contamination during transfer.

(2) Make sure all containers are properly marked before stacking. Check date of filling and store products so that the oldest product can be issued first.

(3) Visually inspect closures for leakage. Tighten, if necessary.

b. Stacking.

(1) *Pyramidal stacking.* To conserve space and to provide stability of stacks, filled 5-gallon gasoline cans should be stacked in pyramids, unless cans are palletized. (See (2) below for method of stacking palletized cans.) To stack cans in pyramids, proceed as follows:

(a) Lay out a 50-foot square.

(b) Build a partial flooring for first tier of cans by laying out rows of 2- by 6-inch lumber or other comparable dunnage and tying in with wooden strips or boards. No dunnage is necessary between tiers.

(c) Beginning at one corner of the square, place six cans side by side along one side of the square. Place cans 6 inches from edge of dunnage and allow %-inch expansion space between the cans.

(d) Place a row of six cans side by side, with backs facing aisle, along adjacent side of square to form an L.

(e) Place three rows of can within the L.

(f) Place a second tier of cans on top 'of the first. Indent the second tier on both sides approximately 3 ⅓ inches so that each can in the tier rests on three or four cans.

(g) Place a third and fourth tier on the stack, indent each tier as described in (f) above. Do not stack cans more than four tiers high.

(h) Continue building the pyramid outward until the entire 50-foot square is completed. Turn cans at the end of each row so that backs of all outside cans in a pyramid face aisle. The first tier should contain 3,528 cans, the second tier 3,403

cans, the third tier 3,280 cans, and the fourth tier 3,159 cans, totaling 13,370 cans in the section.

(2) *Vertical stacking.* Filled 5-gallon cans may be stacked vertically when cans are palletized and forklift trucks or cranes are used. To stack palletized cans vertically, proceed as follows:

(a) Lay out 50-foot-square sections; if necessary, adjust size of section to accommodate a definite number of pallets. It is not necessary to construct a floor for the containers; however, a suitable foundation material should be used.

(b) Place cans upright on pallet and group them close together allowing an even border around pallet. Terrain and equipment limitations must govern the number of tiers of cans on pallets. Size of the pallet will determine the number of cans to be included in the tiers.

(c) Start at one corner of the section and place several pallets of containers along adjacent sides of the section. Pallets should be as close together as possible.

(d) Place additional pallets of containers directly over the first tier until the desired number of tiers is reached. Palletized cans may be stacked higher than single cans, but available handling equipment and stability of stacks must determine the number of tiers.

(e) Continue building stacks until the section is completed. Each stack must be completed to the desired height before the next stack is begun to avoid obstructing the range of the truck or crane.

5-706. Standards for Storage of Packaged Fuels, Lubricants and Greases

a. *Covered storage.*

(1) *General.* All packaged lubricants and greases should be under covered storage, wherever possible. See section 1, chapter II, this regulation, regarding types of facilities and section 6, chapter V for details in storage of Lubricating oils, greases, and paints. Packaging fuels, paint thinner and other low flash products may be stored in buildings provided adequate dispersion and ventilation are obtained and the buildings which are used meet the requirements of the current edition of Flammable Liquids Code No. 30 published by National Fire Protection Association, 470, Atlantic Avenue, Boston, MA 02110.

(2) *Stacking containers.* Layout of sections and stacking height depend upon warehouse design, available storage space, load capacity of floor, and available materials handling equipment. The primary objective in the arrangement of containers is to store the maximum quantity of products in a limited space while maintaining fire control and providing ease and safety in handling the containers.

(3) *Safety precautions.*

(a) Uncased containers' exteriors will be free of grease and oil before being placed in storage.

(b) Follow inspection procedures described in c(1) below.

(c) Additional safety information is to be found in chapter VI.

b. Outdoor storage.

(1) *General.* Although packaged lubricating oils and greases are normally stored under cover, they may be stored outdoors when storage buildings are unavailable and containers are protected from water and heat of sun by fire retardant tarpaulins. The stacking area should be laid out to provide for segregation of products into sections. The lubricants may be stacked on pallets or adequate dunnage.

(2) *Precautions.* Observe precautions described in paragraph 5-705.

(3) *Methods of stacking.* Place necessary dunnage between ground and first tier, and stack containers as follows:

(a) Stack uncovered cylindrical 5-gallon oil cans in an inverted position, with closures on the bottom. Cans may be stacked vertically or in pyramids (para 5-705).

(b) Stack 55-gallon drums as described in paragarph 5-704.

(c) Stack all containers other than 55-gallon drums upright.

(d) When containers are packed in cases, stack cases on pallets or adequate dunnage.

c. *Inspection.*

(1) Inspect stacks periodically for evidence of leakage, abnormal swelling or corrosion of containers, and for stability of stacks. If leakage is apparent, locate leaking containers and remove from the stack immediately. See that all containers requiring shelter are properly covered with fire retardant tarpaulins or other suitable materials and adequate ventilation provided.

(2) Examine markings frequently to see that they are legible. If illegible and it is economically feasible to identify the contents of the container, obliterated markings should be restored.

5-707. Storage of Empty Containers

a. General. Empty containers may be stored in open storage. These containers will be protected from mechanical damage and from contamination of interiors by dirt, water, and other extraneous matter. Tightly closed containers will retard interior corrosion to a great degree. New or reconditioned containers received for storage will have no product markings thereon. These containers require inspection periodically to ensure their usability at all times. Containers evidencing interior or exterior corrosion should be removed for reclamation. Empt y containers previously containing products should be treated as explosion hazards and handled accordingly piror to reconditioning. Closures should be tightly closed as an open bung or vent emits hazardous vapors for some time after removal of product. Uneconomically reparable containers will be salvaged.

b. Stacking empty 55-gallon drums. Normally, empty drums will be stacked in the same manner as filled drums or by the method prescribed by each military service.

c. *Stacking empty 5-gallon cans.* Empty 5-gallon gasoline cans may be stacked by either method described in paragraph 5-705 without regard to height. Occasionally, empty 5-gallon gasoline cans are strapped side by side in groups of five. Those groups may be placed on pallets with cans resting on their bases or their sides. Cans strapped into groups may be stacked vertically without the use of pallets; but dunnage must always be used between the bottom tier and the ground, and containers should not be stacked so high as containers stacked by other methods, unless shoring is placed at ends of each row to prevent stacks from slipping. Filler plugs must be tightened before cans are stacked.

5-708. Handling Procedure.

a. General. Personnel charged with the responsibility of loading, unloading, and storage of filled containers will instruct workmen as to the proper method of handling. Tearing down a pile by pushing, pulling, manually or by the use of powered ground equipment or dropping a container from either a pile or load will not be permitted. When skids are used to ease or expedite unloading, the container will be slid down with the plain end first. Care should be exercised to see that a container is not allowed to strike against another because of possible damage and the creation of a percussion spark which might result in an immediate fire.

b. Handling equipment. When storing petroleum products, the types and quantities of handling equipment is determined by the quantity of product stored, location and arrangement of storage areas, and the height to which drums may be stacked. Typical equipment used in storing petroleum drums include—

(1) Forklift trucks (see OSHA CFR 29 1910.178(b)).
(2) Skids.
(3) Cranes.
(4) A-frames.
(5) Conveyors.
(6) Empty drum track.

c. *Drums bundling attachments, forklift truck.*

(1) Standard types of attachments. The standard types of attachments used with forklift trucks for the handling and storing of commodities in 55-gallon drums are shown in section 2, chapter IV.

(2) *Construction of attachments.* The drum handling attachments for use with forklift trucks will be constructed in accordance with current Military Specification MI L-D-1 1303. The attachments, when constructed to this specification, will incorporate the basic operating and safety features necessary for efficient handling of drummed liquids or semiliquids in 55-gallon drums by supply facilities.

(3) Utilization. The drum handling attachment is used for placing 55-gallon drums into or removing from storage. The drums will be picked up from the horizontal position (drums placed on sides). The drums are transported to and from shipping or hauling vehicles by the forklift truck in combination with the attachments when the distances are approximately 400 feet; or are placed on large warehouse trailers for transporting between carriers and storage location when distances are greater than 400 feet.

5-709. Quality Surveillance

a. Quality surveillance as used herein is the aggregate of measures to be applied to maintain the quality of petroleum products in order that these products may be in a condition suitable for immediate use. The petroleum industry and the military procurement activities make every effort to provide clean and on-specification products. A vigilant qual-

ity surveillance program is necessary to ensure the supply of clean and on-specification products to the using field units. Good housekeeping practices will ensure order and cleanliness, as well as promote safety.

b. Many things can happen to petroleum products to affect their quality and performance value after delivery and during their handling, storage, and dispensing in the depot. For example, careless handling, contamination, exposure to abnormal temperatures, confusion of markings or inefficient control of stock can cause leakage and spoilage, resulting in damage to; and excessive maintenance of equipment.

c. Water is a common source of contamination which can render petroleum products useless for service. Many petroleum products contain various types of additives and the seepage of water into the containers may remove these additives or cause emulsions. The use of such products may result in damage to equipment. Water contamination may result from rough handling, or from improper application of plugs and gaskets, which permits breathing and subsequent condensation of water vapor. Storage of drums on their sides with proper blocking and shoring will avoid the trapping of water on the heads within the chimes.

d. Packaged products opened for "spot" checking or quality surveillance tests should be consumed as *soon as* possible. When *this cannot be* done, the container should be reclosed tightly and marked as having been previously opened.

e. Inefficient supply control of products in a depot can result in spoilage and loss. The practice of "fist in-first out" will reduce spoilage caused by long storage. Check date of filling and store products so that the oldest is issued first.

5-710. Inspection

All filled drums will be carefully inspected for condition and proper *marking* before being put in the storage area. During initial storage of filled drums, semiweekly inspection for leakers will be made of stored drums. After group storage has been completed, periodic inspection should be adequate under normal conditions. If a drum leaks at the closure, it should be tightened, and the gasket replaced if necessary. Drums which show signs of leakage or excessive corrosion or appear otherwise unfit for storage will be removed immediately from the area and the contents transferred to satisfactory containers.

5–711. Safety Measures

a. General. Instructions relative to safety measures and fire protection are covered in chapter VI.

b. Cause of petroleum fires. Fires in packaged petroleum storage areas may be caused by the following

(1) Sparks and open flames can produce explosions and subsequent fires in flammable vapors.

(2) Static electricity can be generated by the passage of fluid through a hose, by agitation of a fluid in a container, by the movement of a truck over the highway and by other means. In the presence of readily falmmable vapors, such an electrical charge constitutes a definite hazard.

(3) Lightning discharge frequently causes petroleum fires.

(4) Leaks not *only waste product* but also constitute fire hazards.

(5) Smoking is a common hazard and will not be tolerated in petroleum storage areas.

c. *Fire plan.*

(1) Every petroleum storage area will have a definite fire plan, with regulations on fire prevention and instructions on fire fighting.

(2) All personnel handling petroleum will be made conscious of the constant danger from frees and of the precautions required,

(3) Proper equipment for fighting fires must be provided in accordance with section H, chapter 7, MIL–HDBK–201.

(4) *Clearance.* The distance from filled drum storage to structures, drum filling plants, operational buildings, and sources of ignition must not be less than 500 feet for low flash products and 200 feet for high flash products. Storage areas for drummed petroleum products must be far enough away from overhead electric lines so that no part of a broken wire can fall upon the drums.

(5) *Arrestors.* Flame and spark arrestors must be provided for all equipment within and adjacent to drum storage areas containing filled drums.

(6) ***Electrical*** *equipment.* All electrical equipment and installations in drum storage areas containing petroleum products and within 10 feet of grade must be in accordance with requirements outlined in the current edition of the National Fire Protection Association Codes, volume 5, class 1, division 2, National Electric Code.

(7) *Vegetation.* Vegetation must be eliminated in outside drum storage areas, and must be kept short on dikes (berms) by frequent cutting. All cuttings or dry vegetation must be removed immediately. A strip 50 feet wide around the outside of the storage area must be free of vegetation and combustible maternal.

(8) Drainage. The drainage system for removing surface water from the storage area must be provided with a means of retaining and removing any petroleum product that may leak into the area.

(9) *Access roads.* All-weather access roads should. be provided either outside or on the dike, to include the drummed storage groups. Access roads will be provided with ramps or graded to allow entrance of materials handling equipment into the diked areas.

(10) *Portable explosion proof extension lights.* The portable explosion proof extension light, constructed in accordance with Military Sepcification MIL–L–83762 (USAF), will be utilized in the inspection of interiors of empty or partially filled drums or any drums, cans, fuel cells, and other containers having contained or containing liquids or semiliquids which could result in the presence of explosive vapors therein.

Section 8. METAL PRODUCTS

5-801. General

The importance of metal to the Department of Defense requires that storage and materials handling methods used will result in metal products being maintained in a ready-for-issue condition at all times. This section establishes standard methods for the storage and handling of metal products such as pipe, bars, steel beams, strip and sheet metal and armor plate. In establishing these methods, it is realized that in some instances, circumstances will determine the method used. The methods and practices outlined herein provide effective means of storing large quantities of metal in a safe accessible manner, permit maximum utilization of storage space with a minimum expediture of manpower, but do not preclude variances and/or substitutions peculiar to a specific problem area or-condition.

5-802. Item identification

Identification of metal products in accordance with current directives of the military services concerned must be maintained to facilitate receipts, issues and inventory. *Proper* identification is necessary to minimize losses or the expense incurred when physical and chemical analysis is necessary for re-identification when identity of the metal has been lost. It is also essential for the effective utilization of metal products.

5-803. Storage Space

a. Warehouse space. Installations having warehouses equipped with overhead bridge cranes should utilize such facilities for the loading, unloading, and handling of heavy or large quantities of metal products. In the absence of such warehouses conventional warehouses and standard forklift equipment should be used for the storage of metal products. Appropriate metal storage racks should be utilized to the maximum extent practicable in order to make full use of cubic storage space.

b. Shed space. Shed storage of metal products will provide protection against rain, snow, and sun. However, this type of metal storage is generally limited to the storage of lightweight products such as pipe, tubing, and angles that can be normally handled by hand. Use of pigeonhole type racks and/or horizontal dunnage in these sheds permits maximum utilization of cubic storage while maintaining accessibility.

c. *Open space.* Open area surfaces utilized for the storage of metal products will have sufficient bearing strength to support the materials to be stored at the height desired. Advance planning is a prime

requisite for effective utilization of open storage space for metal products.

5-804. Storage Aids

a. Dunnage. Dunnage is particularly important for the storage of metal products. Dunnage provides clearance for forks of the fork truck and allows crane hooks or slings to be placed underneath a load. Additionally, dunnage is used to stabilize stacks and keep the metal off the floor or ground or separated from other contaminating materials or objects. The storage of heavy metal products on inadequate dunnage could result in stacks collapsing when ground softens due to thawing, or errosion. Also stacks may collapse on surfaces such as asphalt when the surface softens due to hot weather. Wooden, masonry, or concrete dunnage, as appropriate, should he used as beaming surfaces or for pile stabilization.

b. Pallets. Pallets are utilized for the storage of small metal products such as welding rods, tin, and lead solder.

c. *Storage racks for metal products.*

(1) The following types of racks are utilized for the storage of bar, pipe, tubing, angles, and other elongated types of metal products:

(a) Fixed pigeonhole type (fig. 5-57).

(b) Nesting type with automatic grab hook attachment (fig. 5–58).

(c) Tree frame racks (fig. 5–59).

(d) Lightweight sheet or strip racks (fig. 5-60).

, (e) Concrete forms, timber foundations with special fittings, and uprights imbedded in concrete (fig. 5–61).

(2) Selection of the appropriate rack depends upon the quantity, weight, and issue requirements of the items to be stored.

5-805. Handling Equipment

a. Selection of the proper equipment depends upon the size, quantity and weight of the material, type of storage, and the distance material must be transported.

b. Examples of handling devices, gear and equipment used for the effective handling of metal products are as follows:

(1) Swivel bolsters mounted on warehouse trailers and trailers hooked in tandem.

(2) Tree frame racks mounted on warehouse trailers (fig. 5-62).

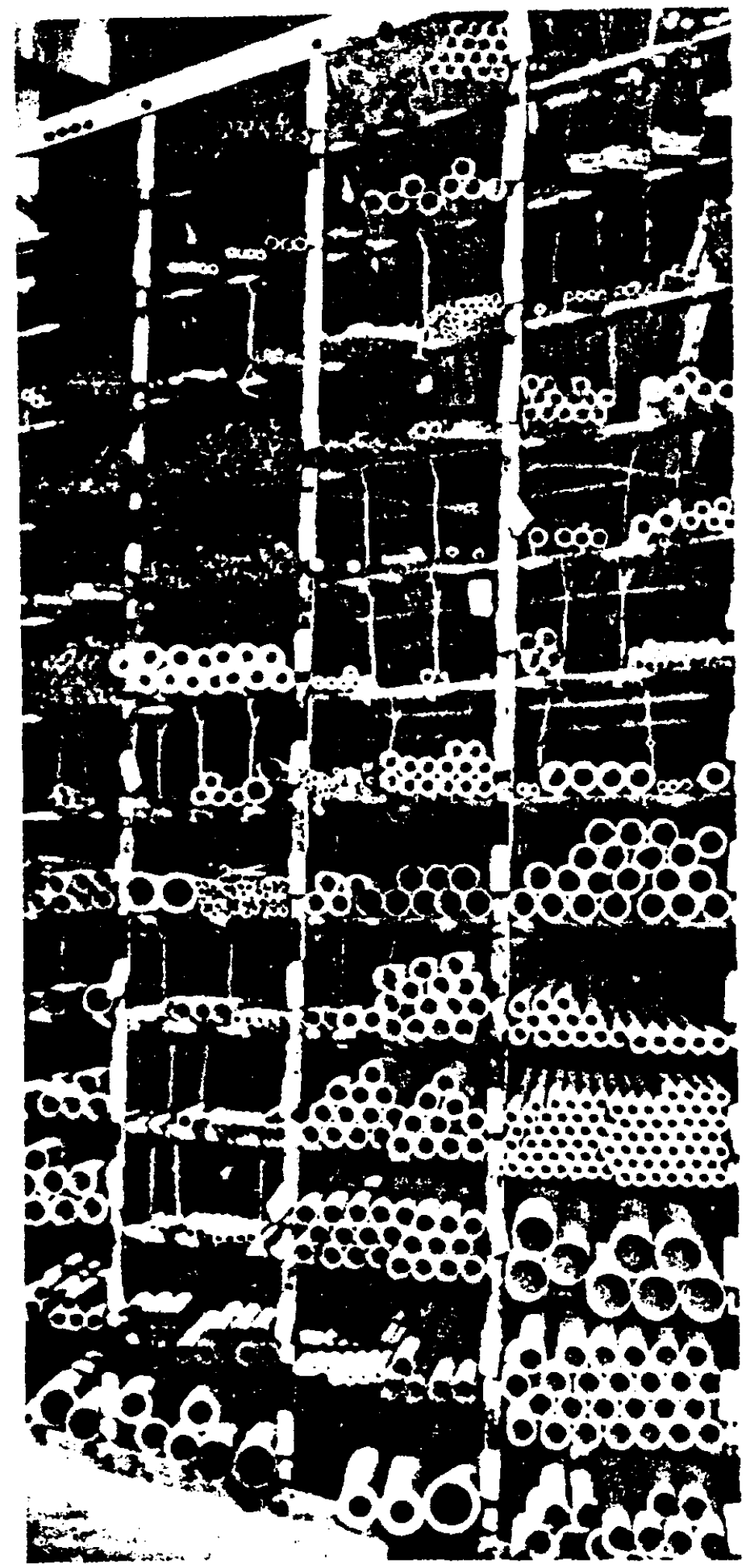

Figure 5-57. Pigeonhole type metal storage racks.

(3) Dollies equipped with cradles or frames (fig. 5-63).

(4) Automatic grab hooks and spreader beams (fig. 5-64).

(5) Overhead bridge cranes, warehouses cranes and forklift trucks (used in covered storage areas).

(6) Locomotive, mobile, gantry and warehouse cranes or forklift trucks (used in open storage areas).

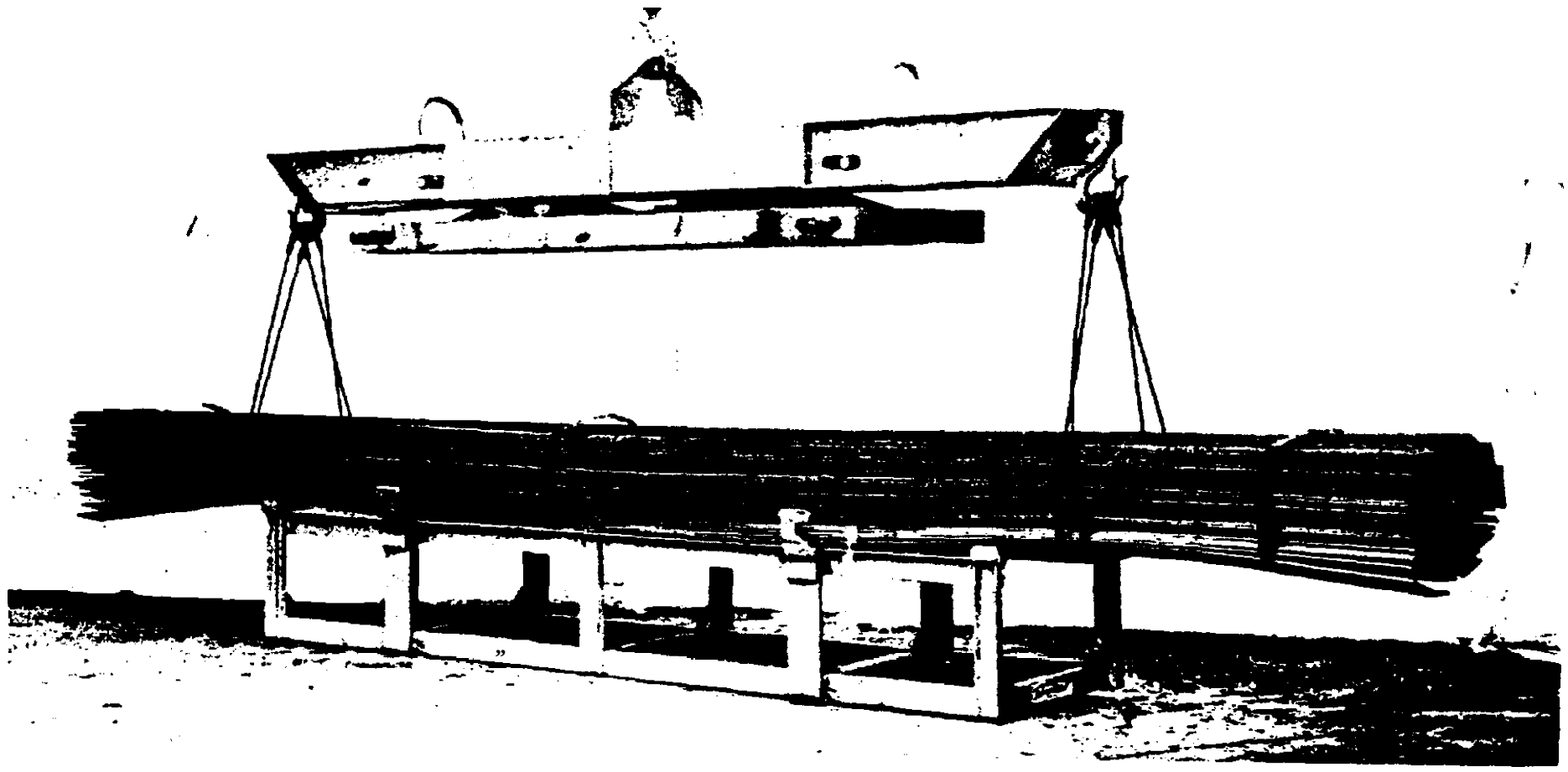

Figure **5-58.** *Nesting* ***type*** *rack with* ***automatic*** *grab hook attachment.*

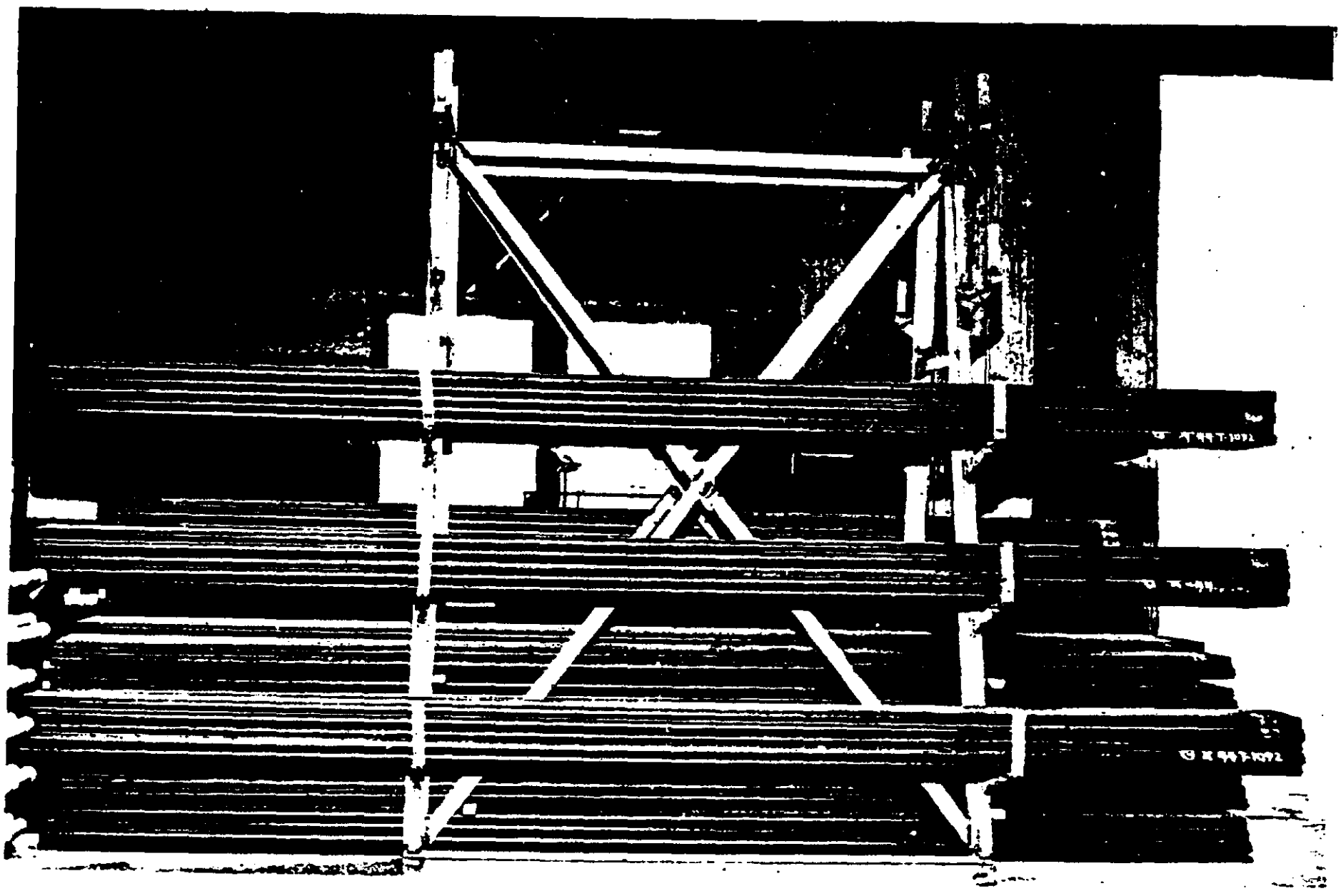

Figure ***5–59.*** *Tree* ***frame*** *rack.*

Figure 5-60. . Lightweight sheet or strip racks.

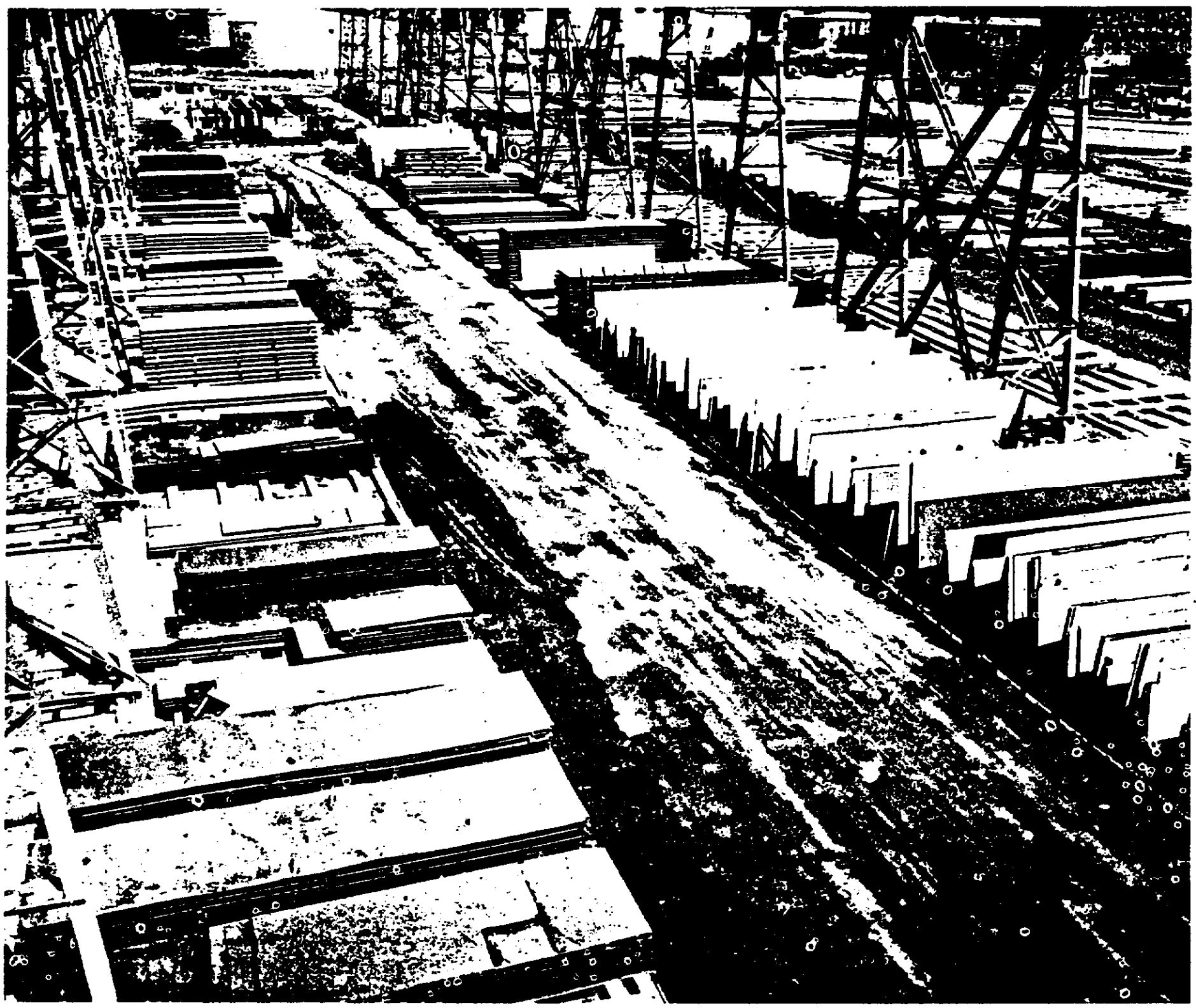

Figure 5-61. Storage of heavy plate and structural shapes.

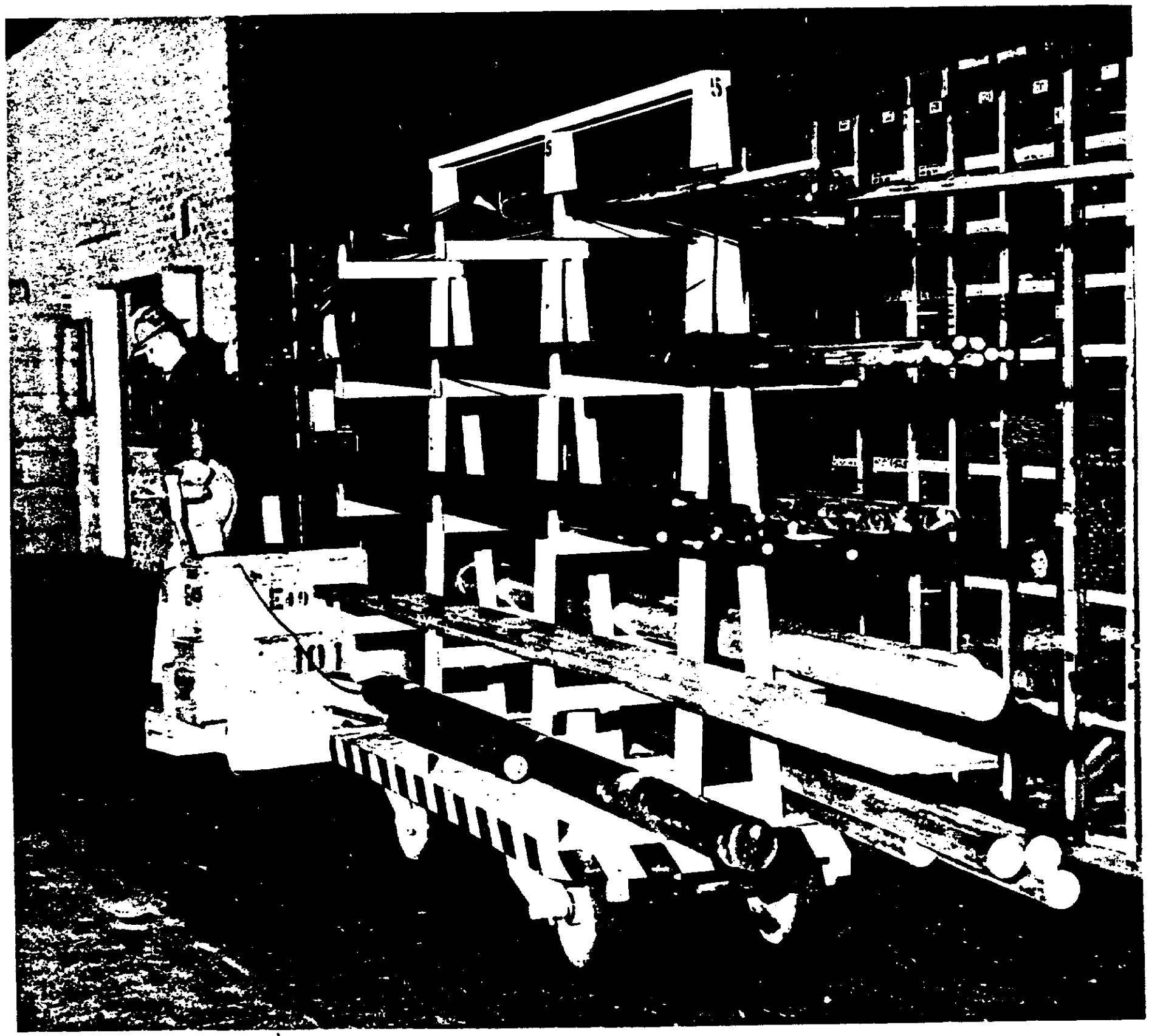

Figure 5-62. Tree frame recks mounted on warehouse trailer.

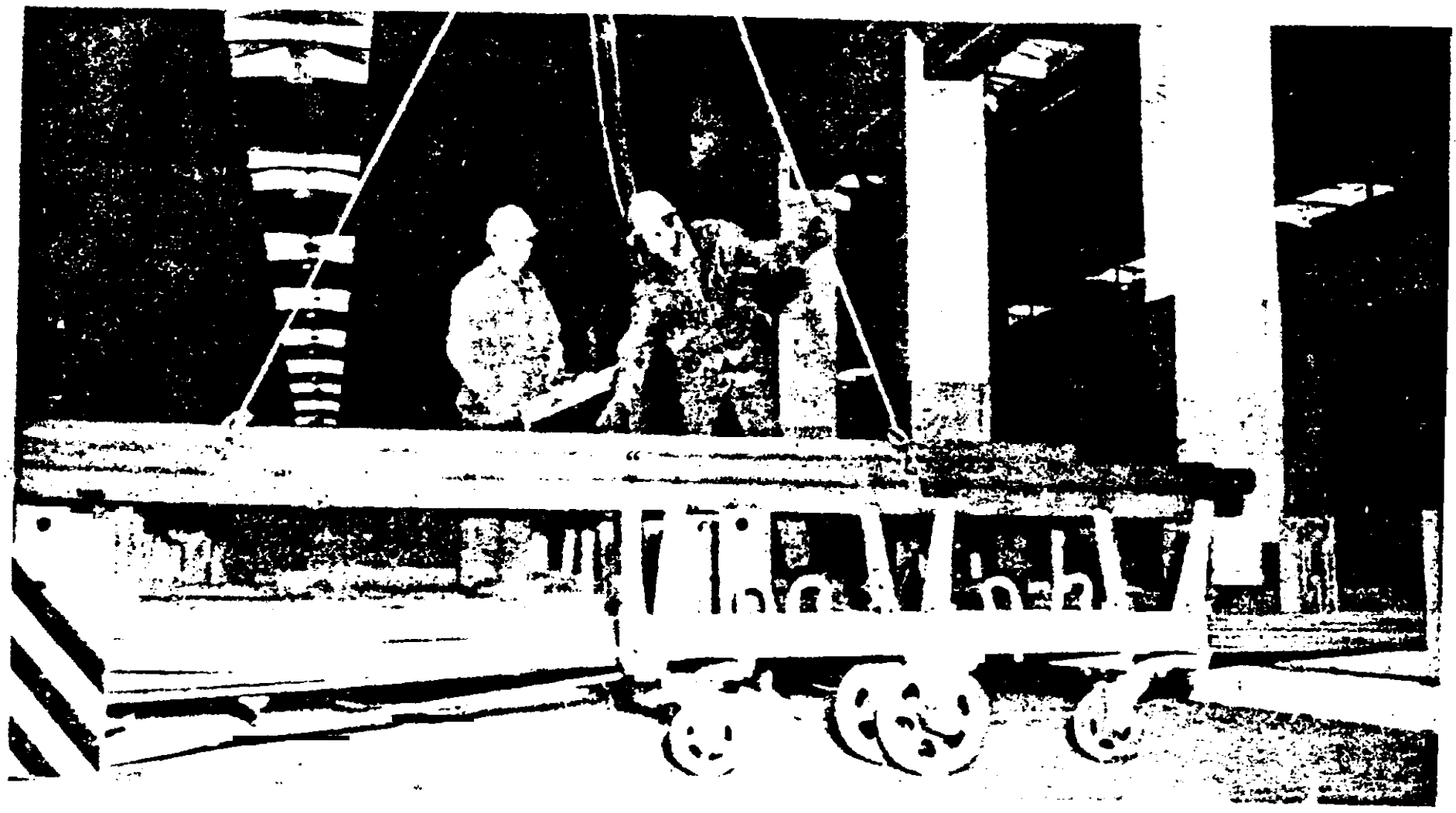

Figure **5-63.** ***Dolly*** *equipped with* ***cradle.***

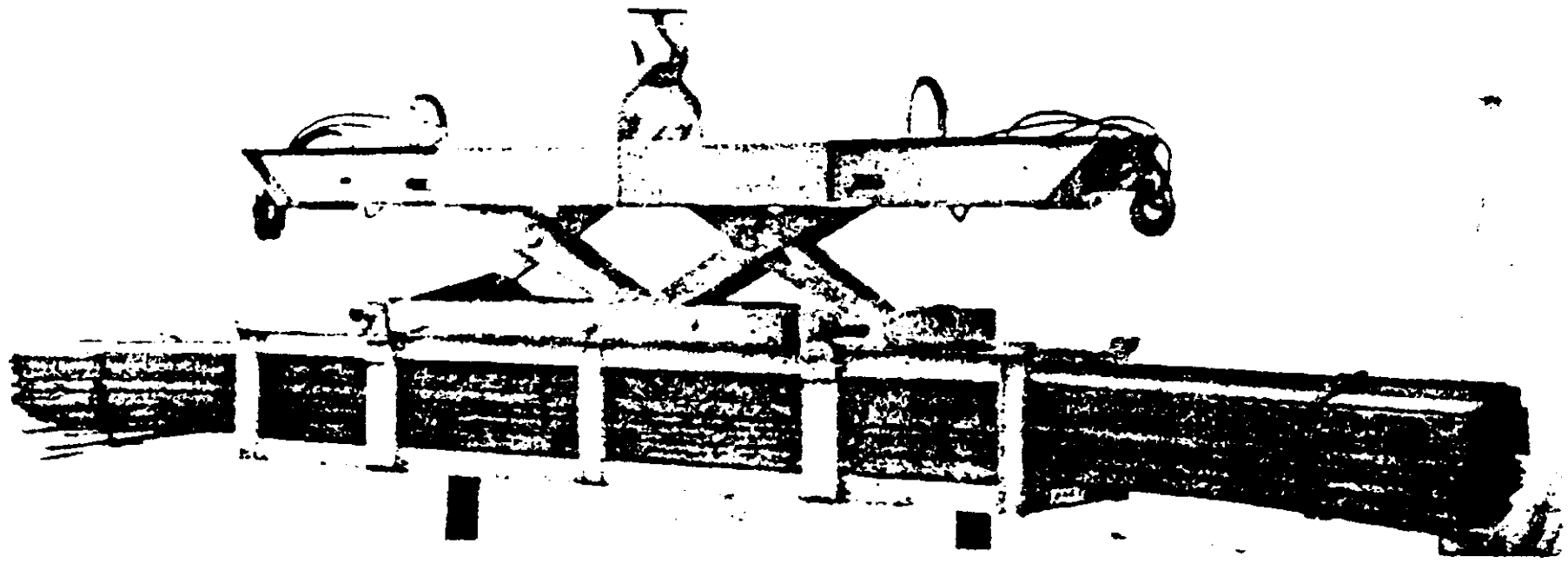

Figure **5-64.** ***Automatic*** *grab hook and spreader beam.*

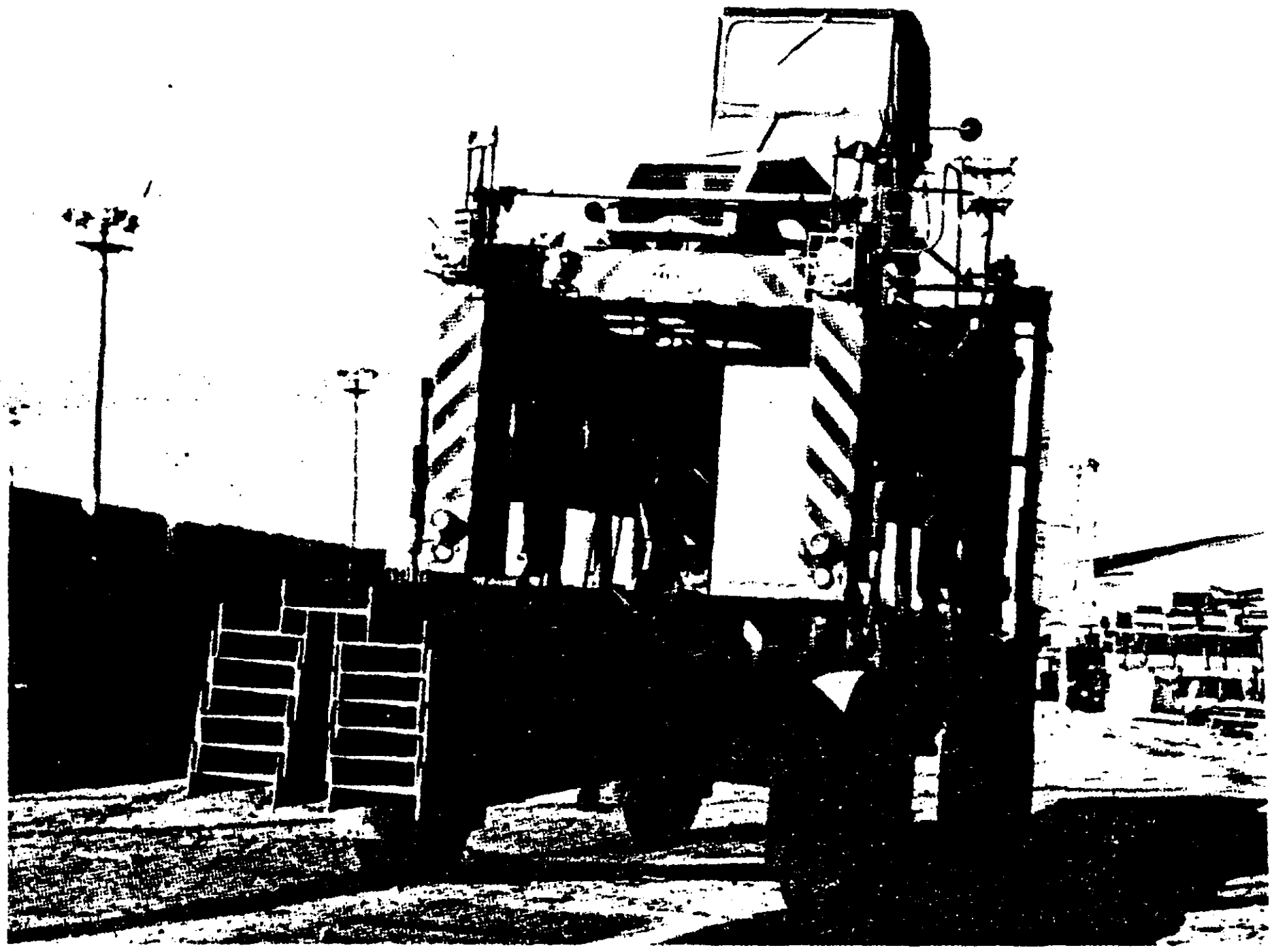

Figure 5-65. *Truck, straddle carry.*

(7) Truck, straddle carry used in conjunction with platforms or racks (fig. 5-65).

(8) Tractor trailer trains, rail cars, trucks and trailers.

(9) Hooks, shackles, slings, clamps, plate grabs and tongs.

5–806. Handling Methods

The methods outlined and illustrated herein are representative of several types currently approved for use by the military services. However, this does not preclude the continuous use or adoption of new storage and handling methods that will produce equal or better results in a more economical or feasible manner.

a. Bar stock, angles, pipe, tubing, and other similar types of elongated metal products.

(1) Replenishment and issues in and out of pigeonhole type racks are usually hand operations; however, dollies equipped with cradles or frames may be used as a handling aid in servicing this type rack. Also cranes may be used for the movement of heavy items on top of the racks. When sufficient room is not available on top of the racks, or when the use of cranes is not practical, the heavier items should be stored in the extreme lower openings of the racks to facilitate handling (fig. 5-66). Generally, movement of this type of material, other than in and out of racks, is accomplished by crane, side carrying fork truck, truck, straddle carrying, swivel bolsters mounted on warehouse trailers and trailers hooked in tandem, tree frame racks mounted on warehouse trailers, dollies with cradles or frames, or any other combination of such equipment as appropriate.

(2) The use of nesting type metal storage racks equipped for use with the automatic grab hook and spreader bar is limited to areas where equipment such as overhead or mobile cranes can be utilized (figs. 5-67,5-68 and 5-69). Materials may be loaded or unloaded directly from the racks, open rail cars, or trucks. Each rack is a separate unit that will nest

Figure 5-66. Storage of materials in pigeonhole type racks.

securely and safely on top of the rack beneath. Care should be exercised when loading the nesting type racks to ensure that the material is "weight centered" lengthwise in the racks. This will improve the safety factor and reduce the swaying of the load when hoisted.

(3) Heavy items and large quantities of bar, pipe, and tubing stock may be stored in warehouses, sheds, or open areas. Materials received in bundles, crates, or other type unit loads will be stored in the unit as received, whenever practical. Dunnage should be placed between each layer of material when stacked and, where necessary, binding cleats or stops will be secured at each end of the dunnage to prevent shifting or rolling of materials (figs. 5-70, 5-71, and 5-72). Stacking height will be governed by safety factors, floor load limits, and types of handling equipment utilized. Handling materials in this type of storage maybe accomplished by fork trucks or cranes with appropriate accessory devices, such as bridles, straps, clamps, or hooks.

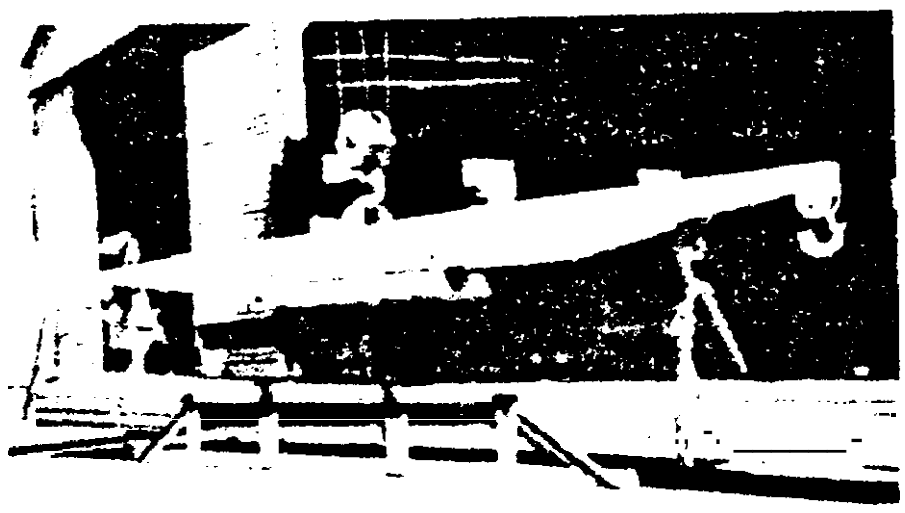

***Figure 5-67.** Combination of crane, automatic grab hook, spreader bar, and nesting reck.*

b. Quantities of small metal products which are issued often, such as drill rod, welding rod, and shim metal, should be stored in pallet racks or bins (fig. 5-73).

c. Strip and sheet metal products should be provided covered storage space when possible. Retail issue quantities are stored in special types of storage racks designed to meet local requirements (fig. 5–60). Handling of these in and out of the racks is normally a hand operation. Appropriate materials handling/transporting equipment is used for other movement. Unit loads (strapped bundles or crates) are block stored on appropriate dunnage to facilitate handling. When covered storage is not available, open storage may be utilized if adequate protection for deterioration is provided (fig. 5–74).

d. Heavy plate and other heavy metal sheets may be stored in covered or open storage depending on space availability and handling facilities. Usually, these items are stored between uprights imbedded in concrete stringer type footings (fig. 5-61). When storage of heavy plate or sheets is utilized, horizontal dunnage will be placed between each layer of material to facilitate handling and to assure a level stack (fig. 5–75). Handling is accomplished by crane with appropriate handling gear such as chips, slings. and straps.

e. Special metal shapes and structural steel, such as angles, beams, and channels, may be stored in the same manner as metal bars, pipe, or tubing.

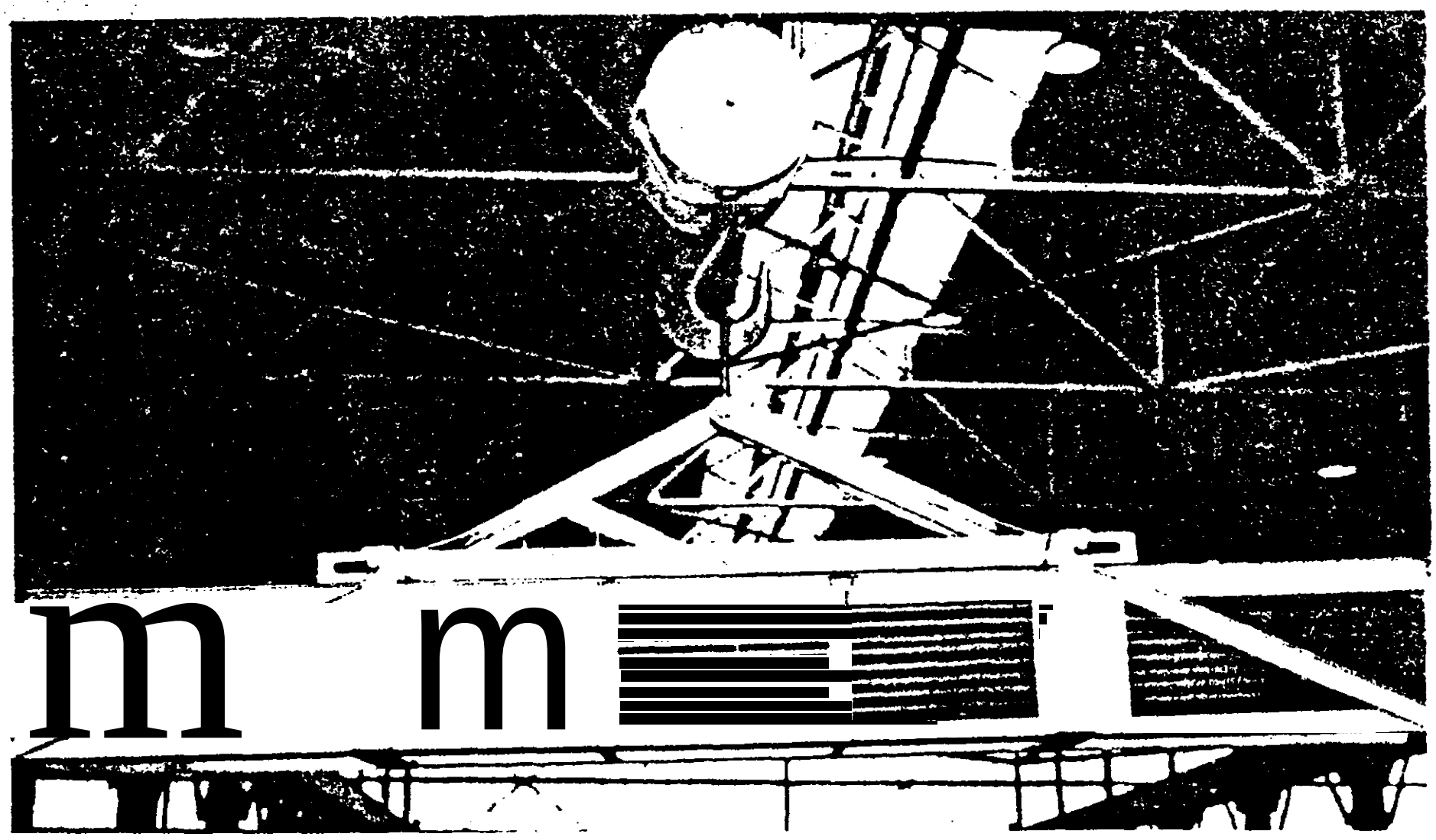

Figure 5-68. ***Crane*** handling ***loaded*** *reck.*

Figure 5-69. Crane positioning rack into storage.

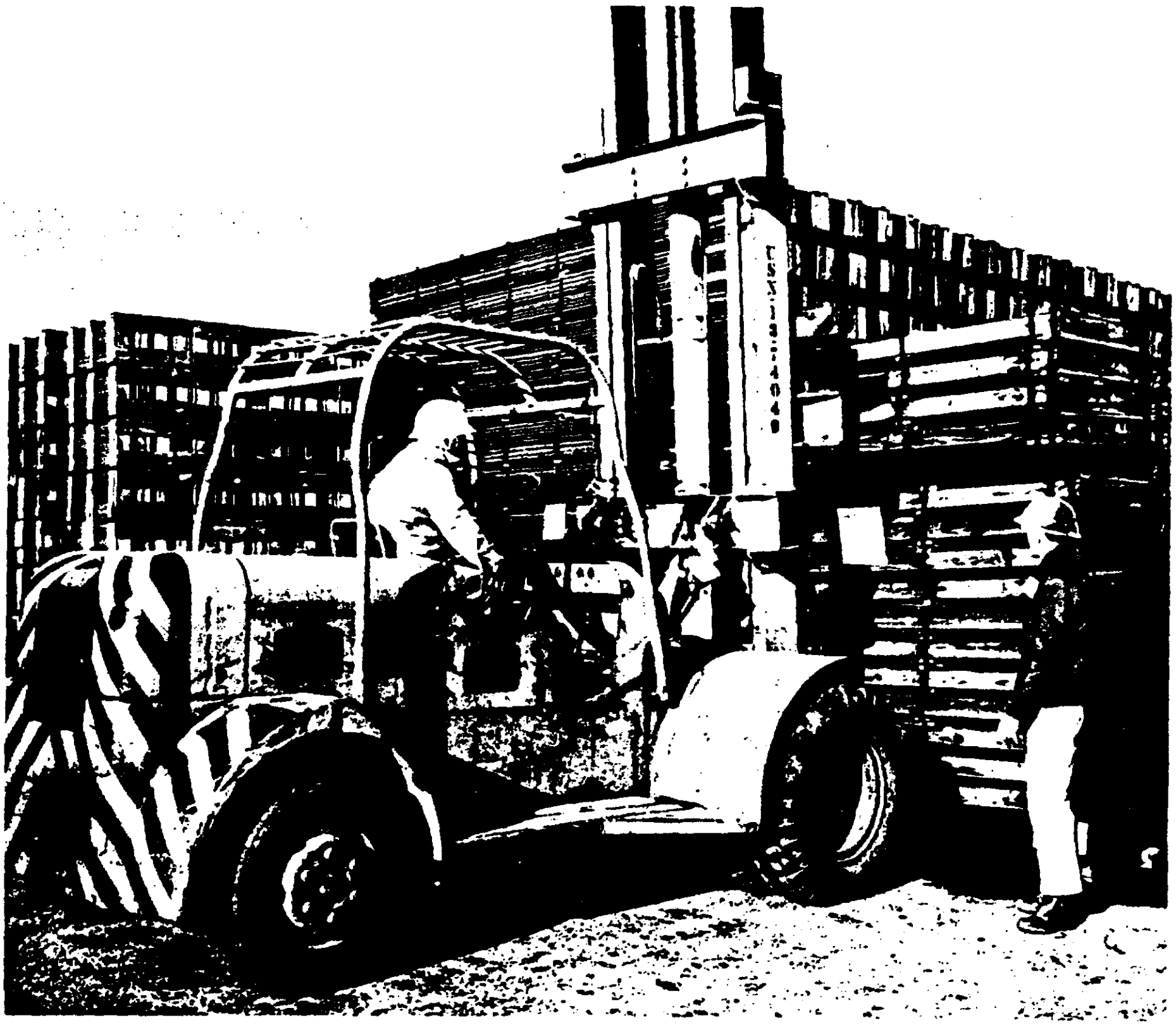

Figure 5–70. *Fork truck operation in open storage.*

Figure 5–71. Open storage area.

Figure 5–72. Storage of odd shapes.

Heavy items or large quantities are normally stored in open space on dunnage and will be adjacent to rail or truck loadinghmloading facilities (figs. 5–76, 5-77, and 5-78). Handling equipment and procedures employed will be substantially the same as for other similar types of elongated metal products.

5-807. Safety

Due to the weight, size, shape, handling and transportation requirements peculiar to metal products, safety must be given prime consideration. Appropriate safety precautions of chapter VI, this regulation, and of the military service concerned will be carried out with emphasis on the following

a. Authorized safety toe footwear will be worn by personnel.

b. Metal studded leather palm gloves should be worn when handling metal as a protection against cuts from sharp edges.

c. Standard hand signals will be used when directing lifting, lowering or movement of materials. Such signals will be given by only one person in an area regardless of the number of personnel engaged in the operation.

d. Supervisors should assure that all personnel engaged in physical lifting have been instructed in the proper techniques.

e. Precautions should be taken to prevent overloading of handling equipment.

f. Special materials handling equipment attachments will not be used without prior approval of the military service concerned.

g. Rail cars, trailers, and trucks will be properly braked and blocked to prevent movement during loading and unloading operations.

h. Floor load limitations must not be exceeded.

5–808. Preservation

Preservation of metal products will be conducted in accordance with current directions of the respective military service. In the absence of specific instructions, MI L–STD–163 establishes the basic requirement for the preservation of steel products. MIL–HDBK–721, Corrosion and Corrosion Protection of Metals, provides useful data for prevention of corrosion. Condensation of atmospheric moisture on metal surfaces is a common cause of corrosion. It is not necessary for bare metal surfaces to be exposed for corrosion reaction to take place. Nonwaterproof coatings, wrappings, and such can absorb sufficient moisture to support a corrosive

Figure 5–73. Storage in pallet racks.

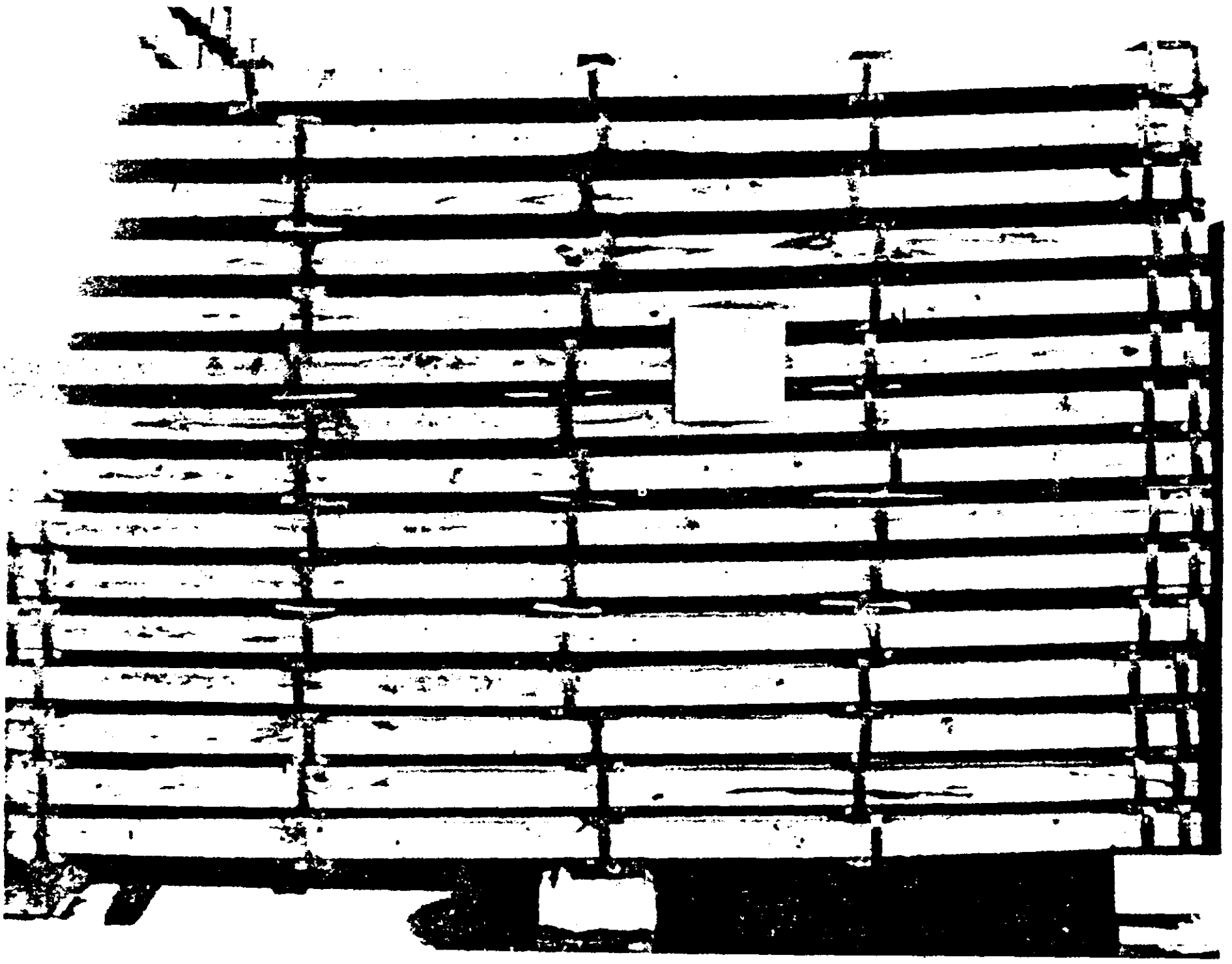

Figure 5-7.$. *Stropped bundles of steel* ***in open storage.***

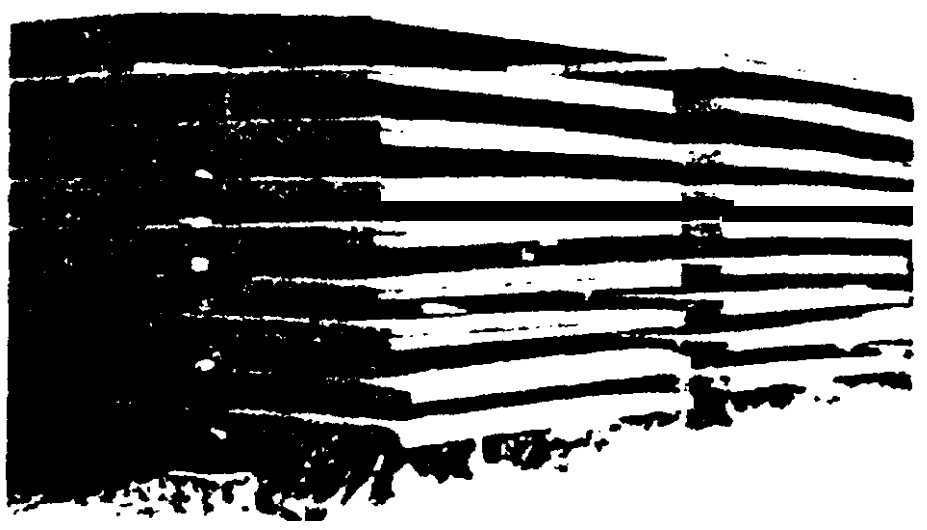

Figure 5-75. *Use of horizontal* ***dunnage*** *in* ***flat*** *storage of* ***armor.***

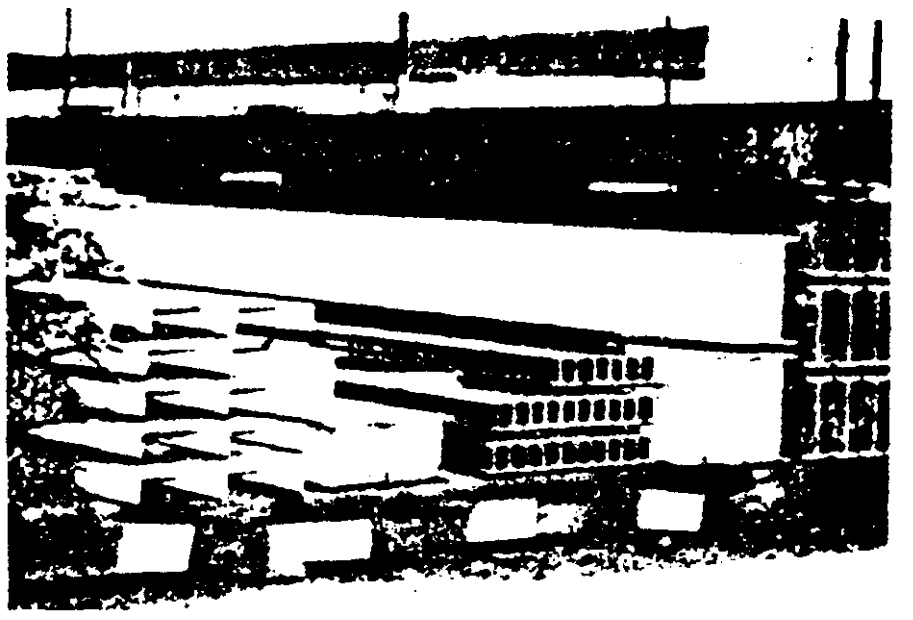

Figure 5-76. Open *storage of metal* ***shapes.***

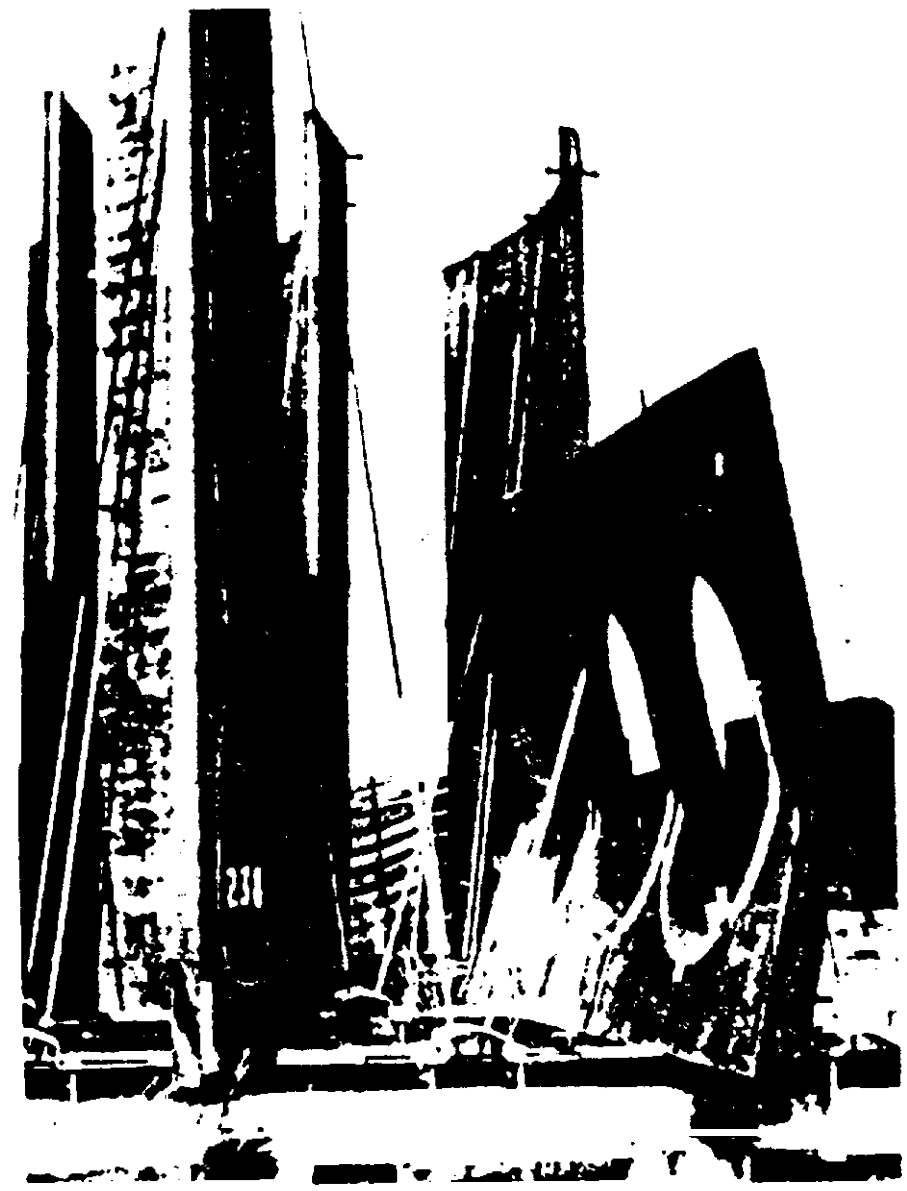

Figure 5–77. Storage of large and heavy items.

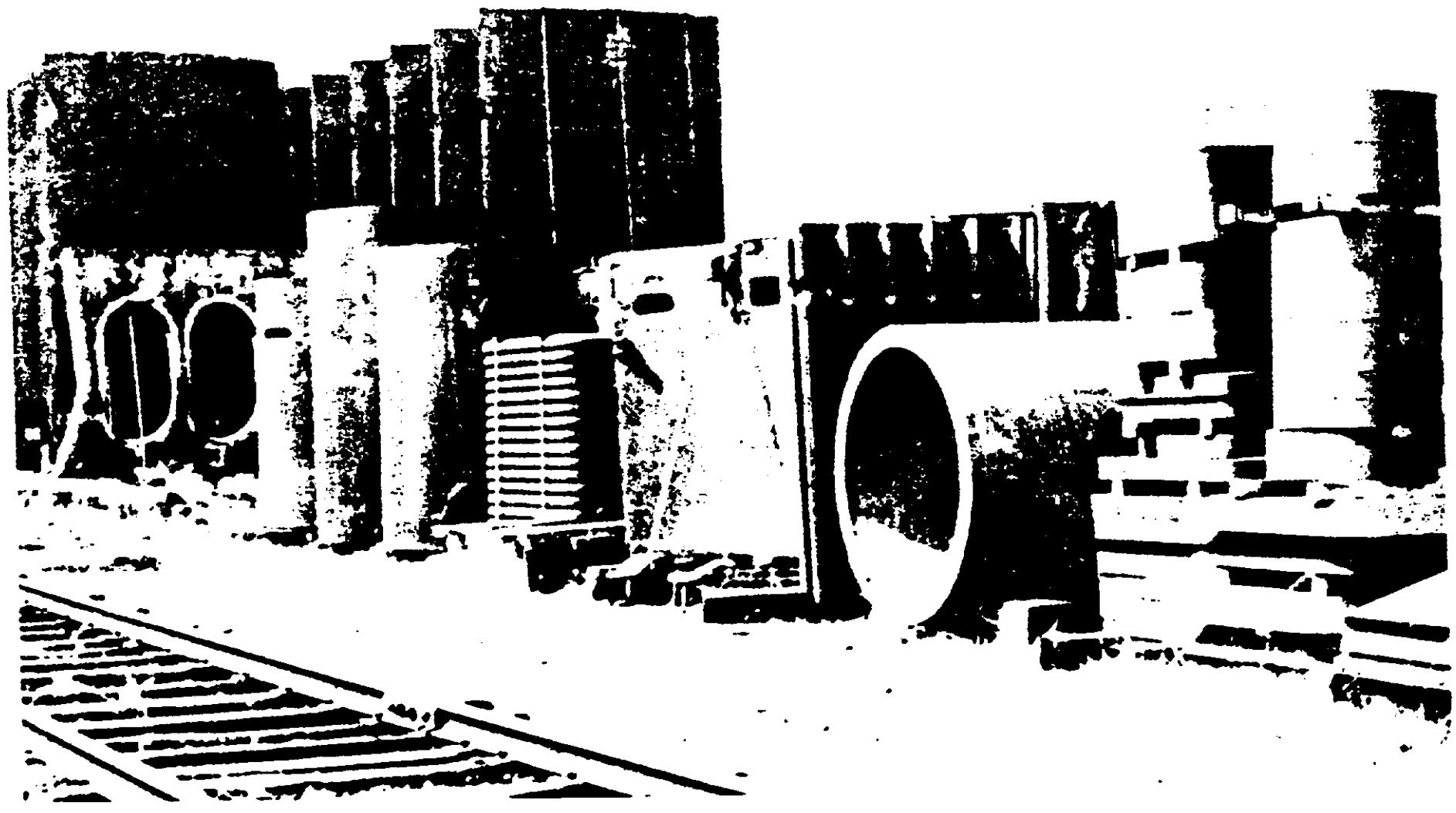

Figure 5-78. Open storage adjacent to rails.

reaction. The prime causes of corrosion are the nature of the materials and unfavorable storage environments. Metal products are more susceptible to corrosion in areas having higher relative humidity than in dry, arid areas. Metal with a polished surface should always be handled with gloved hands to protect the metal from acid stains caused by perspiration. When preservatives are to be applied to metal products, the surface to be coated will be dry, clean, and free from mill scale, dirt, and corrosion. It is essential that materials which have been treated with a preservative are not unduly handled, especially during the setting of the coating. Scheduled surveillance inspections are required to evaluate the continuous effectiveness of the preservative. Metal products stored in open areas for long periods of time may require repeated application of preservative.

Section 9. CABLE STORAGE AND HANDLING

5–901. General

Cable and wire products are wound on spools and reels to facilitate storage and handling. Spools containing wire range in diameter up to 12 inches and the weight usually does not exceed 25 pounds. Reels will range in diameter from 12 inches up to 108 inches, and in weight from about 50 pounds up to approximately 5 tons. This wide range of weight and cube necessitates the use of careful storage and handling practices.

5-902. Storage

a. Cable should be stored indoors in a cool dry location. When indoor storage is not possible, lead covered, jute-protected, and tape armored cables may be stored in an open shed or in the open, protided the cable and cable reel are protected against moisture absorption from the ground. This can be accomplished by placing the reels on a raised platform or on planks which will provide air circulation under the reels. Cable will not be stored in close proximity to oils, acids, or chemicals.

b. Because most heavy or large diameter cable is wound on the reel with few layers (normally five to eight), but with the number of turns three to four times the number of layers, it is best to store a loaded reel in the vertical position, so that the inner layer on the top of the barrel will have the weight of only four to seven layers on top of it. If the same reel were stored on the side (horizontal) position, the cable turn next to the bottom flange would be subjected to the weight of all turns above it and be more susceptible to damage.

c. Quantities of cable with the same stock number may be pyramided as shown in figure 5-79. The storage area should have crane service available to facilitate the storage and issue of reels. Storage areas with low ceilings should be utilized to the greatest extent possible for vertical storage of sin-. gle lot items to reduce the loss of cube space.

d. Small reels, less than 36 inches in diameter, of electrical or wire cable on reels without wood lagging may be stored horizontally but they should be handled carefully, especially when being tiered.

(1) Dunnage required for horizontal storage is usually 3 by 3 inches and of sufficient length to adequately support the reel of cable being stored (fig. 5-80). However, dunnage thickness requirements will be determined to a great extent by the weight of the reels being stored and the distance the hub assembly protrudes from the reel flange surface. Sufficient space must be maintained between reels to permit the entrance of the forks of materials handling equipment. Two parallel pieces of dunnage should extend completely across each reel in the stack and between the base reel and the floor. The dunnage should be placed vertically in line in order to distribute the weight of superimposed reels over as much of the surface of the lower reels as possible, thereby providing maximum stack stabilit y.

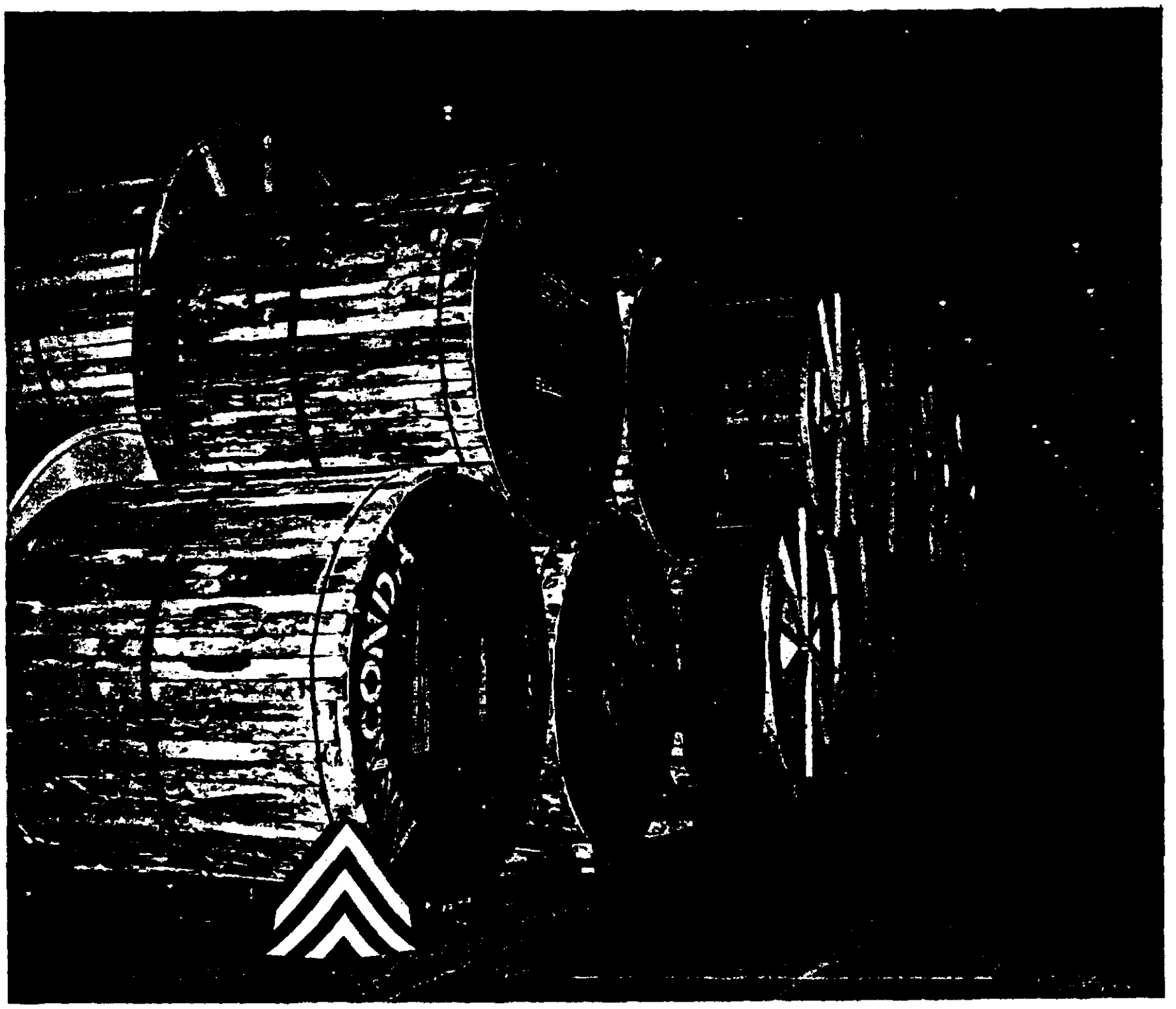

Figure **5-79.** *Pyramid stacking of cable reels.*

(2) Many small reels of cable and wire products, due to their size, should be stored in bin or pallet racks. This is especially true of small spools of wire or small lot quantities of cable or wire which are received in cartons or coil quantities. Generally, these items will be located in the bin issue area and the back-up stock stored in pallet racks.

5-903. **Handling of Cable**

a. Cable reels are usually well constructed and capable of withstanding considerable abuse. However, serious damage can be incurred through improper handling. It is therefore necessary that care be exercised in the movement and handling to avoid damage to the reel or its contents.

b. When handling cable reels by crane, a spreader bar should be used to prevent the sling from crushing the reel (fig. 5-81). Unless reels are handled with a spreader bar, the inward thrust of the sling may severely damage the reel flange and cable. Therefore, activities storing and handling cable on reels should provide spreader bars for use in crane handling operations. Slings should be attached to a bar running through the hub of the cable reel and not by placing the sling over the lagging around the circumference of the reel. Placing the sling around

Figure 5–80. Small cable reels properly dunnaged for safe efficient stacking.

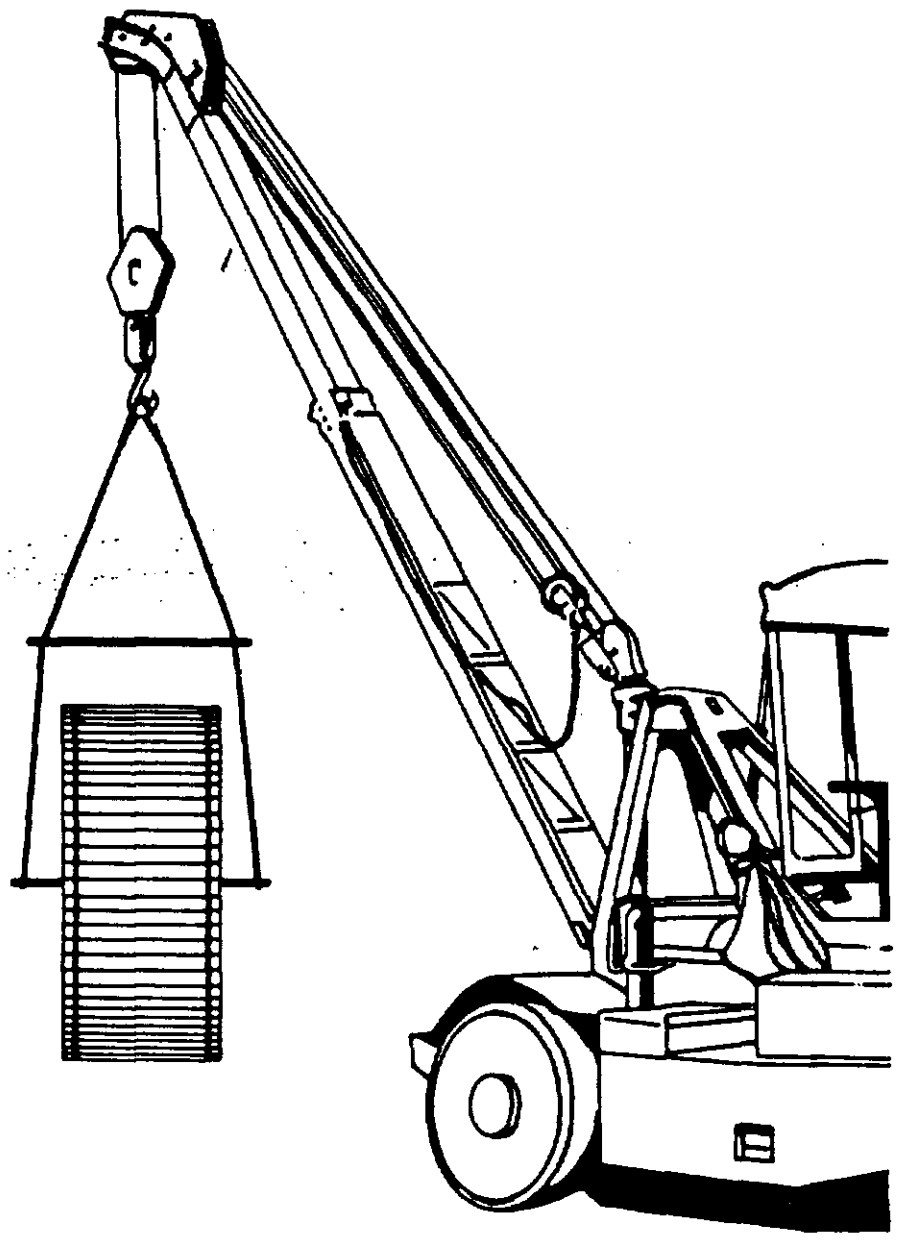

Figure 5–81. Handling cable reek by crane with spreader bar.

the circumference of the reel may result in damage to lagging and cable and require extensive repairs.

c. The fork truck is commonly utilized in the storage and handling of cable, especially where the reels are stored on their side. When handling reels with a fork truck, a crane should be used to place reels in a horizontal position. Reels should not be tipped and allowed to fall to a horizontal position, as the impact may damage the reel or cable. To further facilitate storage operations, it is good practice to place on each reel, prior to being stored, necessary dunnage to support the reel of cable to be superimposed on the stack.

5-904. Cable Rereeling

At most military activities, cable rereeling is not required to the extent that special reeling equip ment is necessary. Most storage activities issue only full reel quantities of cable. There is, however, a demand for less than full reel quantities at some activities where cable is issued for use. Reeling of all types of cable is required to fill retail quantity requirements. Activities which are required to issue electric cable in retail lots should provide personnel with cable reeling equipment, which will permit economical and safe operation.

a. Basic factors to determine need of cable rereeling equipment.

(1) Cost of equipment.
(2) Availability of empty reels.
(3) Cost of additional manhours required.
(4)" Savings of manhours when making issues.
(5) Number of less "than full reel issues.

b. Methods and equipment.

(1) Reeling equipment *required.* The reeling equipment required should be determined by the quantity of cable issued in less than full reel quantities. At activities where small quantity issues are infrequent, hand reeling equipment as shown in figure 5–82, should be utilized. However, if large quantities of less than full reel quantity issues are made, powered reeling equipment will be more economical.

(2) *Cable reeling dispenser.* Two methods of supporting the full cable reel during reeling operations which have proven very satisfactory are:

(a) To support the reel from which the cable is to be removed on a horizontal roller bearing sup port turntable (fig. 5-33).

(b) To insert a shaft through the axis of the reel and support the shaft with cable reel jacks (fig. w) .

c. *Measuring tie.* A measuring device should be utilized in all rereeling operations. This device should be located between the reeling equipment and reel dispenser and so positioned that the footage indicator for cable transferred between reels can be easily seen by the operator (fig. 5-32).

d. Cable cutter. Cable cutting devices should be utilized for cutting cable. Multicircuit cable should be cut with circular cutters only. Straight shearing action cutters distort the ends of the circuit wires within the sheathing and make splicing or use of the cable difficult.

5–905. Protection of Cable Ends

When cut, certain types of cable will absorb moisture from the atmosphere or other sources rendering the cable useless for the purpose intended. It

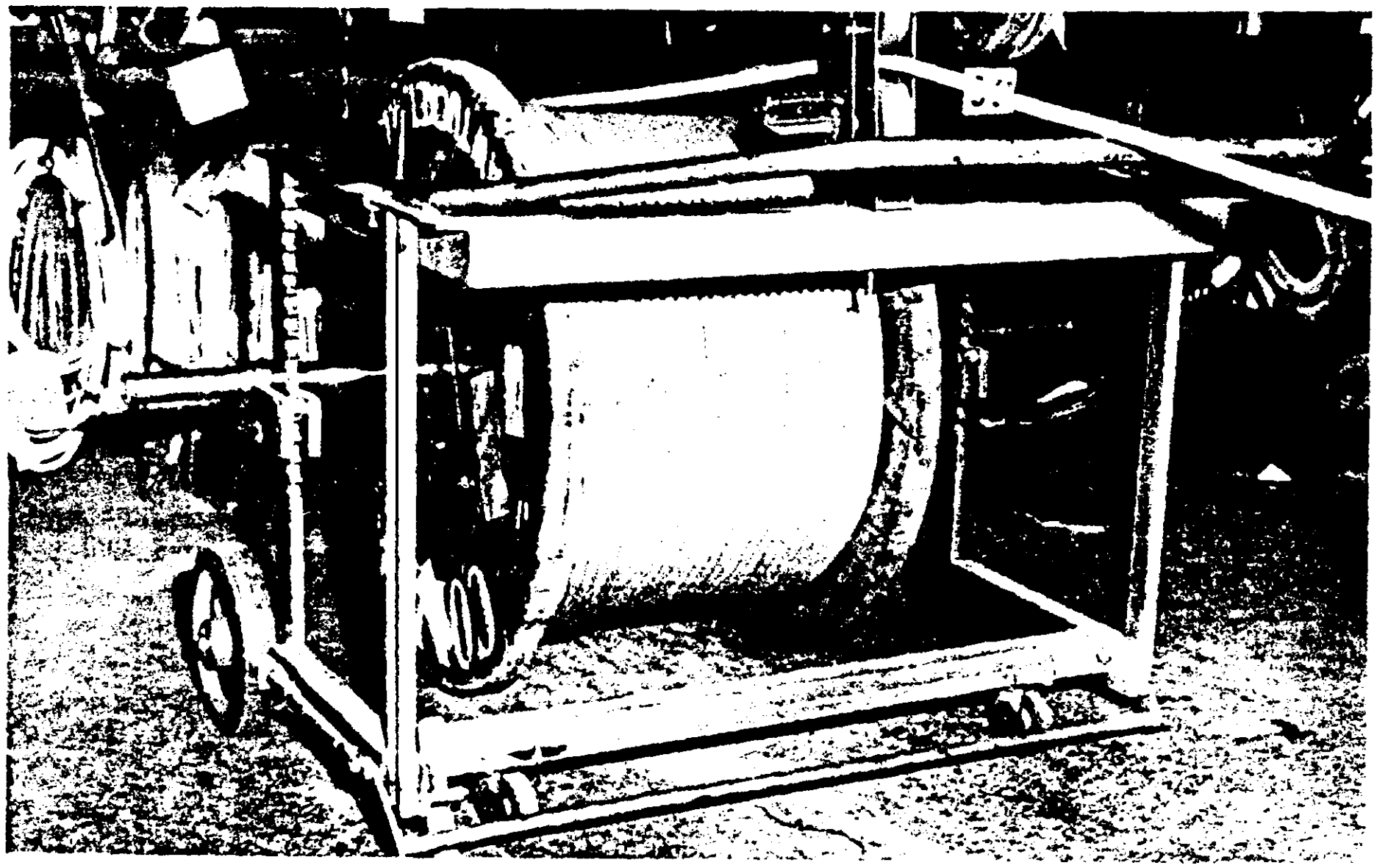

Figure 5-82. Hand operated cable reeling unit and measuring device.

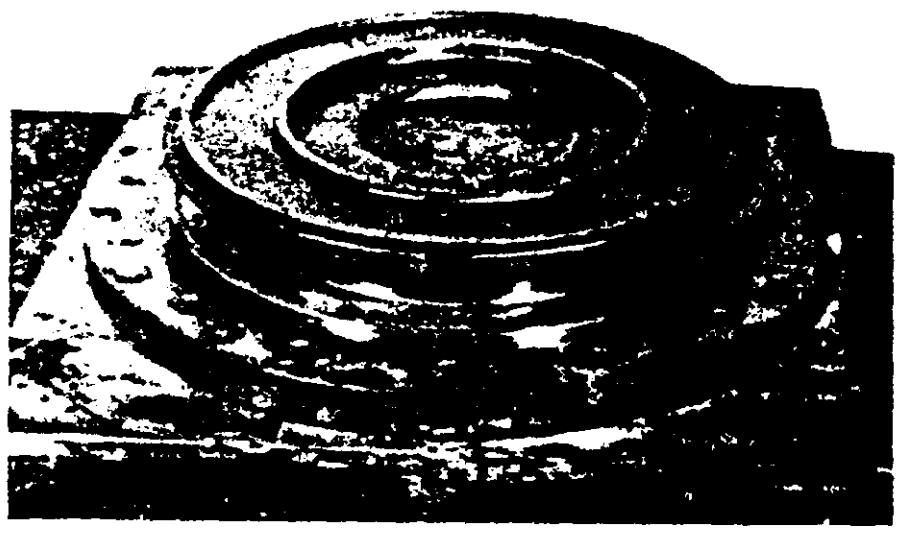

Figure 5-ss. Cable dispensing turntable.

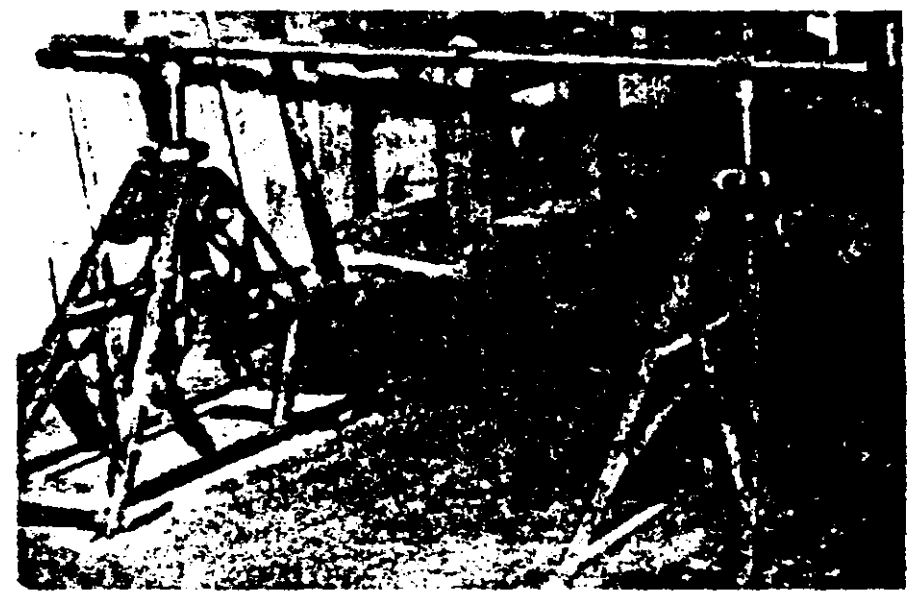

Figure 5-84. Cable dispensing bar and jacks.

is mandatory, therefore, that immediately following cutting of this type of electrical cable, each of the severed ends must be sealed in accordance with *Military* Specification MIL-C-12000. Cable which has not been end-wrapped *after* cutting must be checked for moisture penetration prior to issuing.