

## Chapter 12

# Road Surfacing

This chapter covers surface treatments and the road-surfacing equipment used to apply these treatments. Surface treatments include the following: seal coat, sprayed bituminous material with cover aggregate (single and multiple surface treatments), and asphalt emulsions or slurry seal. Paving and surfacing operations are discussed in FM 5-436.

### **SURFACE TREATMENT**

12-1. The term *surface treatment* covers a wide range of applications and materials, with or without aggregate, applied to the top of a road or pavement. Surface treatments with aggregates can be—

- **Single surface.** A single surface treatment is a sprayed bituminous material with an aggregate cover that is one stone in depth. Use a single surface treatment as a wearing and waterproofing treatment. This type of surfacing requires a minimum of equipment, materials, and time.
- **Multiple surface.** Repeating the single surface-treatment process results in what is referred to as a multiple surface treatment. A multiple surface treatment provides a denser wearing and waterproofing course and the multiple layers add strength to the road structure.

An initial single or double surface treatment may, when time and material are available, be supplemented by additional surface treatments or thicker pavement structures. This process is referred to as *stage construction*.

### **SURFACING EQUIPMENT**

#### **SWEEPER**

12-2. A sweeper is a tractor-type machine with one or more brooms for removing dust from the surface of the existing roadway before laying new asphalt. Remove dust or dirt to ensure proper bonding between the new asphalt and the base course or old pavement. When surfacing a prepared base course, remove the dust layer either by sweeping with the sweeper or by wetting the base course and recompacting. Before using a sweeper, always inspect for excess bristle wear and check that the power drive on all brooms is operating properly.

## ASPHALT DISTRIBUTOR

12-3. The Army asphalt distributor (*Figure 12-1*) is a truck-mounted unit. It has a 1,500-gallon insulated storage tank with a low-pressure heating system, a hydraulic-powered pumping unit mounted on the rear, and an adjustable spray bar for distributing bituminous material. To produce a uniform application, an asphalt distributor requires constant attention. It is critical that the asphalt heater and pump be well maintained. Calibrate all gauges and measuring devices properly (pump tachometer, measuring stick, thermometers, bitumeter, and so on). Use clean spray bars and nozzles and set them at the proper height above the surface receiving the application.

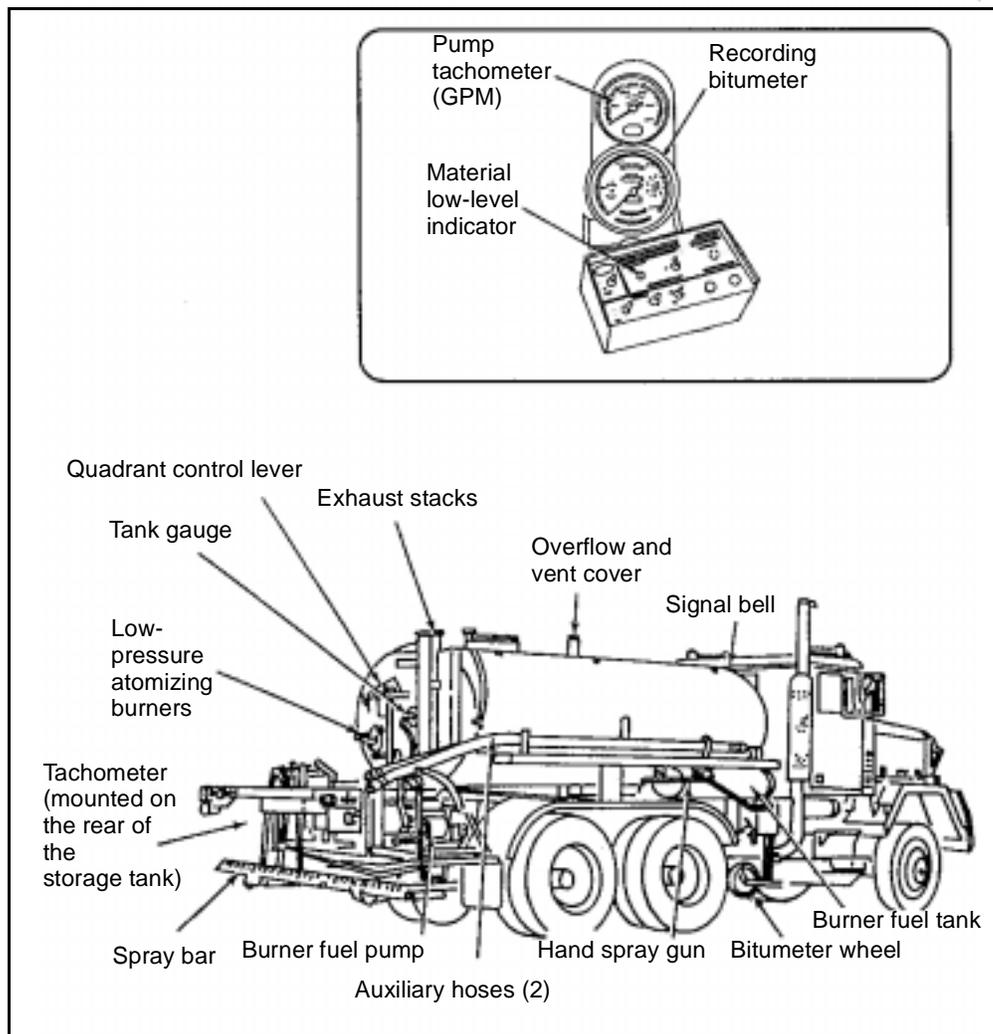


Figure 12-1. Army Asphalt Distributor

### Heating System

12-4. The system's two diesel burners each have an air blower that provides low-pressure air for atomizing burner fuel. The burners emit flame into two U-shaped fire tubes located in the bottom of the asphalt storage tank. Maintain 3 inches of asphalt cover over these fire tubes to prevent

overheating and possible fire or explosion. Perform heating only in a well-ventilated area with the distributor truck level and at a complete stop. *Table 12-1, page 12-4*, is a guide for asphalt spraying temperatures.

### WARNING

Exercise extreme caution while heating the asphalt to prevent damage to the heating system and possible fires and explosions.

## Spraying System

12-5. The spraying system consists of piping, an adjustable spray bar, a bitumen-pump tachometer, and a bitumeter. Use *Table 12-2, page 12-5*, to determine the proper settings for a desired application rate. The application rate is controlled by—

- The length of the spray bar.
- The bitumen pump output. The pump tachometer dial in the cab of the truck (*Figure 12-1*) registers the pump output in GPM from the tachometer mounted on the rear of the storage tank.
- The forward speed of the distributor truck. The bitumeter mounted inside the truck cab monitors the forward speed in fpm.

12-6. **Spray Bar.** The spray bar may be full-circulating or noncirculating, depending on the model of the distributor. The bar can be adjusted to provide coverage from 8 to 24 feet in width. Along the bar there are a series of nozzles with hand-operated valves to control the flow of asphalt. Although the spray bar may have either 1/8- or 3/16-inch nozzles, the 1/8-inch nozzle is appropriate for most applications. For a uniform application, make sure that the spray bar is at the proper height and that all nozzles are the same size and free of obstructions.

- **Spray-bar height.** To achieve a uniform double or triple overlap for a single-layer application, the height of the spray bar must be properly adjusted above the pavement. It is important to maintain the correct height during the entire application. If the spray bar is too low or too high, streaking will result.
- **Nozzle spacing.** Spray bars are usually constructed with either a 4- or 6-inch nozzle spacing. With 4-inch nozzle spacing, the best application results are attained using a triple lap of the spray fans (*Figure 12-2, page 12-6*). To determine the proper spray-bar height for triple-lap coverage, open every third nozzle on the spray bar. Raise the bar until there is single-layer coverage along the entire length of the bar. Do a visual inspection to determine this. When all the nozzles are opened, this height will furnish a triple lap of the spray fans. Use the same procedure for double-lap coverage except only open every other nozzle. When using 6-inch nozzle spacing, the height of the bar necessary to give a triple-lap coverage will frequently allow wind distortion of the spray fans, resulting in a nonuniform application. Therefore, with 6-inch nozzle spacing, only a double lap may be achieved.



Table 12-2. Asphalt-Distributor Application Rates

Gallons Per Sq Yd	Nozzle Size (Inch)	Bitu-meter Reading	Pump Tachometer Readings (GPM)															
			Spray-Bar Length (Feet)															
			8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	24
0.10	1/8 3/16	900 1350	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.20	1/8 3/16	450 675	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.25	1/8 3/16	360 540	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.30	1/8 3/16	300 450	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.40	1/8 3/16	225 340	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.50	1/8 3/16	180 270	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.60	1/8 3/16	150 225	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.70	1/8 3/16	130 195	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.75	1/8 3/16	120 180	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.80	1/8 3/16	110 170	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
0.90	1/8 3/16	100 150	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
1.00	1/8 3/16	90 135	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
1.10	1/8 3/16	80 120	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
1.20	1/8 3/16	75 110	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
1.25	1/8 3/16	70 105	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
1.50	1/8 3/16	60 90	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
1.75	1/8 3/16	50 80	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
2.00	1/8 3/16	45 70	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
2.50	1/8 3/16	35 55	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240
3.00	1/8 3/16	30 45	80 120	90 135	100 150	110 165	120 180	130 195	140 210	150 225	160 240	170 255	180 270	190 285	200 300	210	220	240

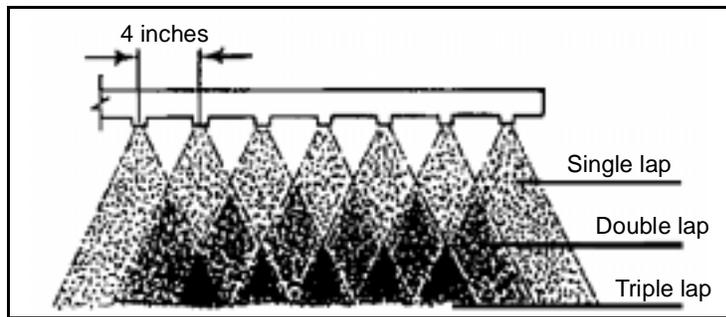


Figure 12-2. Perfect Triple Lap

- Nozzle angle setting.** To attain a good edge, the end nozzles are often set at a different angle ( $60^\circ$  with respect to the spray bar) from the other nozzles. Do not permit this practice because it produces a fat streak on the edge and robs the adjacent spray fan of the lap from this nozzle. A curtain on the end of the bar or a special end nozzle with all nozzles set at the same angle gives more uniform coverage and makes a better edge (Figure 12-3).

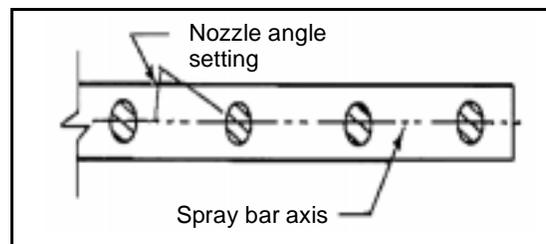


Figure 12-3. Proper Nozzle Angle Setting

12-7. **Bitometer.** The bitometer (Figure 12-1, page 12-2) has a small rubber-tired wheel mounted on a retractable frame under the distributor. A cable leads from the wheel to a dial in the truck cab. The dial registers the distributor's rate of travel in fpm and the travel distance in feet. Some bitometers, besides providing travel distance, correspondingly register the application rate in gallons per square yard. Check the bitometer at regular intervals to ensure accurate registering of speeds. The bitometer check procedure is as follows:

- Step 1.** Mark off a distance of 500 to 1,000 feet on a straight, level surface.
- Step 2.** Drive the distributor at a constant speed over this length while timing the trip with a stopwatch.
- Step 3.** Determine the distributor speed in fpm and compare this calculation with the bitometer reading recorded during the run.
- Step 4.** Repeat this procedure for a number of different speeds, bracketing the speed to be used for spraying.
- Step 5.** Tabulate or plot on a graph errors found at various speeds so a correction can be readily applied when using the distributor.

**NOTE: Keep the bitometer wheel clean to ensure accurate registering of the truck's speed. Asphalt buildup on the wheel causes errors.**

## AGGREGATE SPREADER

12-8. Use the towed aggregate spreader (*Figure 12-4*) to apply aggregate to freshly sprayed asphalt surfaces. It has a 2.5-cubic-yard capacity charging hopper, an aggregate feed roller, an adjustable strike-off gate, traction tires, a towing tongue, and a travel axle. During spreading operations the spreader connects to the dump truck with a two-point, quick-coupling hitch but is supported by its traction tires. It can apply aggregate when being towed or when pushed by the dump truck that is supplying aggregate to the charging hopper. Push the spreader with the dump truck for surface-treatment operations. This allows the aggregate spreader and the dump truck to ride on the freshly laid aggregate. As the aggregate spreader moves along the project, the rotation of the traction tires drives the aggregate feed roller. Control the application rate (pounds per square yard) of the aggregate with the adjustable gate setting. The application width ranges from 4 to 8 feet, in 1-foot increments. Control the width of application by installing blocking plates inside the charging hopper. The blocking plates merely block off a segment of the gate opening.

**NOTE: It is important to spread the aggregate immediately after application of the asphalt, before the asphalt cools.**

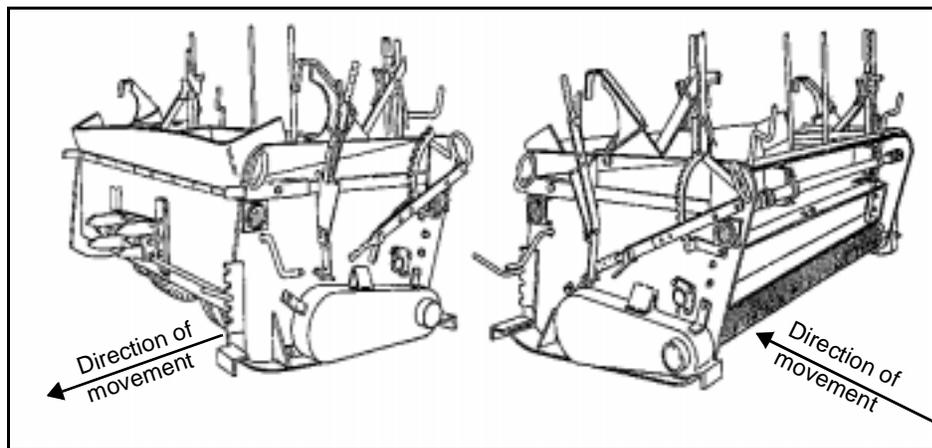


Figure 12-4. Towed Aggregate Spreader

## ROLLER

12-9. All rollers must be in good mechanical condition and able to start, stop, and reverse smoothly. They must have a water-sprinkling system to keep the drums or tires wet so that asphalt will not stick to the drum surface and scar the new surface. Operate the rollers on the asphalt with the drive wheel toward the spreader or asphalt paver. This pulls the mix under the roller and imparts a smooth surface. Placing the rollers on the asphalt with the guide roller toward the spreader will push the hot asphalt forward (*Figure 12-5, page 12-8*). This causes the material to mound up in front of the roller. Eventually, the roller passes over the mound, leaving a bump in the finished pavement. In most cases, subsequent rolling cannot correct this bump.

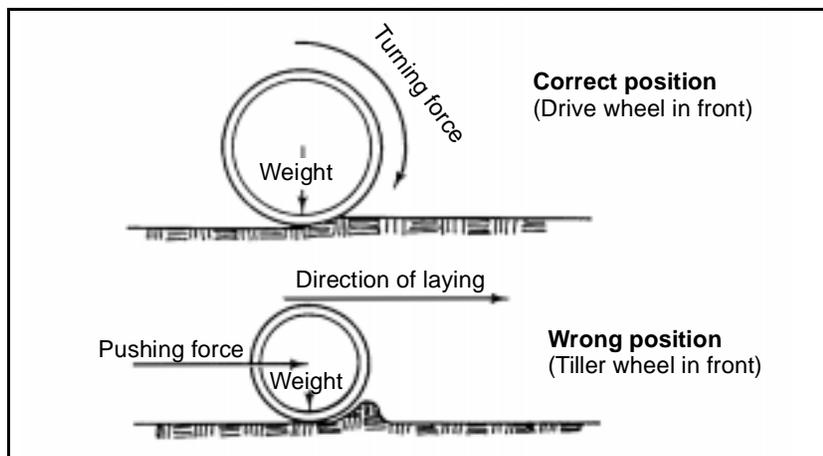


Figure 12-5. Correct Roller Drive-Wheel Position

### Dual-Drum Vibratory Roller

12-10. A 7- to 14-ton, dual-drum vibratory roller can be used for compacting surface treatments, normally after application of the second layer of aggregate. However, the roller should not be so heavy or the vibration amplitude set so high that it crushes the aggregate particles.

### Pneumatic-Tired Roller

12-11. A pneumatic-tired roller is the preferred equipment for compacting bituminous surface treatments. See *Chapter 11* for information on pneumatic-tired rollers.

## IN-PLACE MIXING EQUIPMENT

12-12. The Army has two pieces of equipment for in-place mixing of asphalt or other stabilizing agents—grader and stabilizer-mixer.

### GRADER

12-13. Use a grader to spread the aggregate, either from piles or by scarifying in-place material. After applying the liquid asphalt with the distributor, use the grader to mix the asphalt and aggregate thoroughly. For mixing, pitch the blade all the way forward and angle it to side cast the windrow. Normally, it takes five or six passes with the grader to thoroughly mix the materials after each asphalt application. See *Chapter 4* for additional information on asphalt mixing with a grader.

### STABILIZER MIXER

12-14. The stabilizer mixer is preferred over a grader for road mixing materials. It is faster and provides better control of the asphalt/aggregate ratio, producing a thoroughly mixed material. First, use the mixer to loosen in-place materials and to blend select aggregate. The asphalt distributor supplies asphalt directly to the mixer pump through a flexible metal hose. When using this hose, connect the two units with a safety chain to prevent damage to the hose. Spray the asphalt onto the aggregate with a spray bar mounted under the mixer hood. The spraying takes place while the mixer is

moving and the tines are rotating. This procedure completely blends the asphalt and aggregate. See *Chapter 11* for additional information on stabilizer mixers.

## BITUMEN HANDLING AND DEDRUMMING EQUIPMENT

### ASPHALT MELTER

12-15. The asphalt melter (*Figure 12-6*) melts asphalt from 55-gallon drums and heats it to a prescribed pumping temperature. The upper section of the melter consists of dual, dedrumming tunnels; the lower section consists of an asphalt melting and storage tank. In dedrumming operations, cut away one end of each 55-gallon drum. Then place the drum, open end down, in the dedrumming tunnel. Use an oil heater in conjunction with the asphalt melter. Hot-oil coils, running along the sides and bottom of the tunnel, provide the heat to melt the asphalt in the drums. Additional hot-oil coils, running throughout the storage tank, bring the asphalt to mixing temperature. *Table 12-1, page 12-4*, is a guide for asphalt mixing temperatures in pug mills.

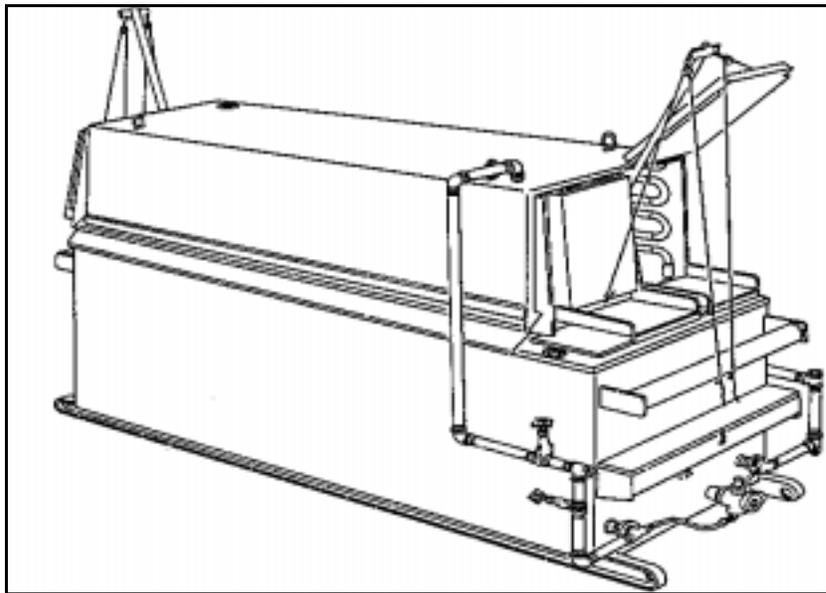


Figure 12-6. Asphalt Melter

### OIL HEATER

12-16. The oil heater heats and then circulates the hot oil to systems such as an asphalt melter or a storage tank. A diesel burner provides the heat to raise the temperature of the circulating oil. A pump circulates the hot oil to the systems. Set the heating requirements on the heater's temperature controller. From that point on, a programmed circuit automatically controls the operation with a check-and-balance safety procedure. If the system malfunctions, safety devices cause the unit to shut down. The oil heaters come mounted on liquid-asphalt storage-tank trailers.

## ASPHALT KETTLE

12-17. The 165-gallon asphalt kettle (*Figure 12-7*) is designed primarily for surface patching and maintenance operations. The trailer-mounted tank consists of an outer shell encompassing a 165-gallon capacity storage and heating tank. A removable distillate burner, mounted inside the outer shell, provides heat to the kettle. A flue carries off the exhaust gases. A small, two-cylinder gasoline engine provides power to the asphalt pump. Asphalt is applied to small patching projects through a flexible hose and a handheld spray assembly.

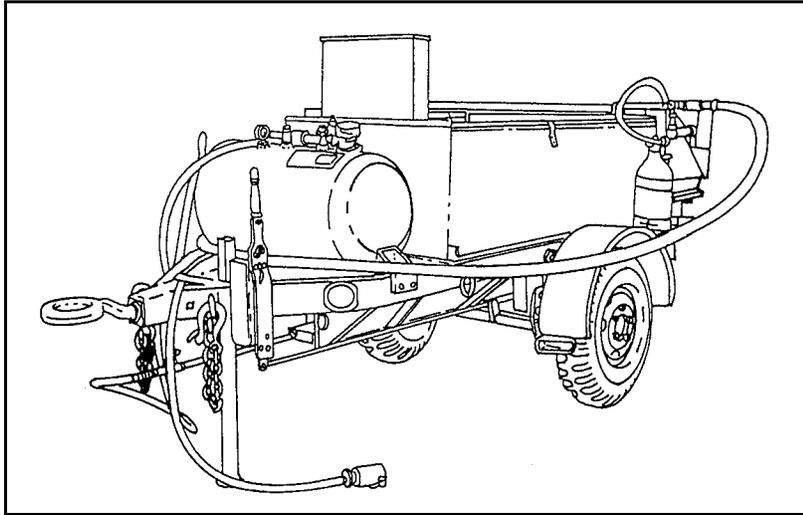


Figure 12-7. Asphalt Kettle

## SUPPORT EQUIPMENT

12-18. Use a rough-terrain forklift to transport and lift asphalt drums and mineral filler. See *Chapter 6* for information on forklifts. Use a loader to maintain aggregate stockpiles and for other material-handling operations. See *Chapter 5* for information on loaders.