Broadcast Seeders

Broadcast-type seeders are used to advantage on some projects. Seeding equipment in use by a contractor on the Columbia Basin Project, Washington, employs two electrically operated broadcast seeders followed by a 15-foot width of chain harrow, Figure 9. The chain harrow follows small irregularities in the soil and is not as subject to clogging with weed, brush, and debris as the spike tooth harrow. On the other hand, the chain harrow cannot be weighted for scarifying the heavier soils.

Fig. 9

The jeep-mounted electric seeder shown in Figure 10 also was used on the Columbia Basin Project, Washington for seeding of wet areas not accessible to two-wheel drive equipment. This is an electrically powered broadcast seeder with controls in the cab of the pickup.

Fig. 10

The seeding equipment described below and shown in Figure 11 was particularly useful in the placement of heavy seed such as barley and wild oats, wild oats being the adapted vegetation on nearby rangeland. A high quantity of seed, by weight and by volume, was required on each acre. By the use of this type of equipment, long slopes could be seeded rapidly. The total cost of seed and seeding was less than the normal cost of seeding perennial grasses.

Grass types and seeding time were adjusted so that no covering was necessary. Banks which were not roughened by the normal contractors finishing practices, were scarified with a spike tooth harrow prior to the broadcasting of the seed.

The seeder performs very efficiently and with the exception of seeding by helicopter, it is the fastest method used on the Central Valley Project, California, for seeding large spoil banks and ditch-bank areas. The seeder has been borrowed on several occasions by other public agencies who also have found it to be fast and efficient.

Fig. 11

For seeding slopes the seeder is used on the left side of the pick-up truck as shown. For seeding larger areas, the seeder is mounted over the tail gate. It is mounted on a platform designed to fit in the bed of a pick-up truck, so that the broadcaster hangs over the side or end of the truck bed. The operator on the pick-up controls the speed of the seeder engine so that the seed is broadcast 10 to 50 feet onto the spoil banks. On level ground the truck travels 8 to 10 miles per hour.

The illustrations, Figures 11 and 12, do not show the attachment for handling small seeds, but such an attachment is furnished with the seeder. By using the grass seeding attachment, both large and small seeds or two different kinds of seeds can be planted at the same time without mixing prior to seeding.

The seeder has a built-in metering device so that the adjusted density of the broadcast seed is uniform, whether the fans are throwing seed 10 feet or 40 feet.

Fig. 12

In mounting, the seeder used on the canal banks of the Central Valley Project, Figure 12, a platform, large enough to fill the entire pick-up truck bed, was secured to the bed. The platform should be sufficiently high to permit the seeder to rest on the platform and on the side or tail gate of the truck bed. The seeder was attached to the platform by two bolts on the back side and two clamps, which are furnished with the machine.

Some modifications were made to the seeder on the project, which improved its operation and the results obtained. These modifications were:

(a) The addition of a hand throttle to control the speed of the fans, rather than use of the engine governor for this purpose.

(b) The seed reflector behind one fan was extended approximately 8 inches to the outside so that all the seed cleared the truck bed.

(c) Bushings were placed behind the gears operating the fans so that the gears had a closer fit and ran smoother at high speeds.

(d) The engine pulley was replaced with a smaller one. A 1-1/2-inch pulley was found best.

It was discovered that by closing one aperture and disconnecting the broadcaster from the same side, the opposite broadcaster would then throw sufficient seed a greater distance (when needed) than when both broadcasters were operating. One fan was sufficient to distribute seed with the seeder mounted on the side of the truck; however, for larger areas with the seeder mounted on the tail gate, the two fans were used. The second fan can be removed by loosening one set screw from the gear on the fan shaft, shown in Figure 13.

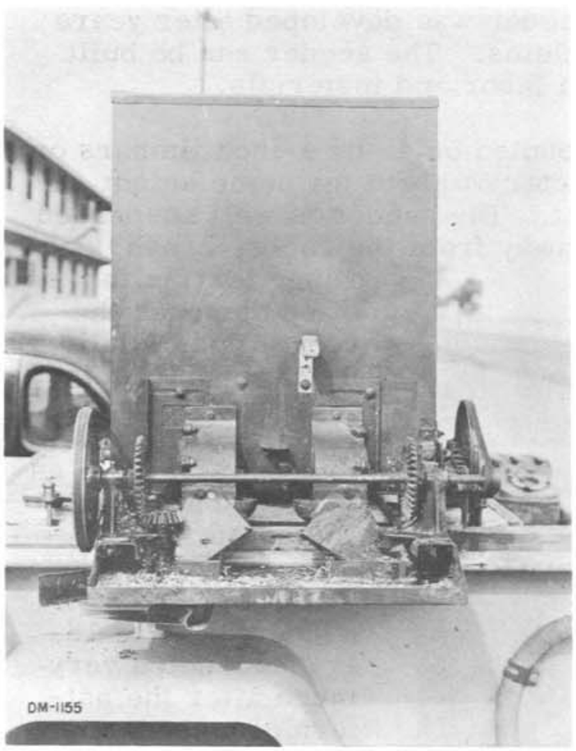


Fig. 13

Except for the above and keeping the gears well coated with a heavy gear grease to reduce wear, the project forces found no need to improve upon the seeder as furnished.

The seeder cost approximately $150, complete with engine and grass-seeding attachment.

Gravity-flow-type Seeders.

Several adaptations have been made of the gravity-flow-type seeder. Seeding of narrow strips of waterline with grasses may require a box only 2 or 3 feet long with two or three seed openings. A light-weight box may be attached to a retractable boom and a light-weight spike, chain, or spring-tooth harrow could be attached to follow if covering of the seed is desirable.

An even simpler seeder was used on the Columbia Basin Project, Washington. This seeder consisted of a 1- or 2-quart can with a closeable lid (such as a coffee can or shortening can). It was attached to a bamboo fishing pole and red top, a grass seed which is extremely small but heavy, was seeded at the rate of approximately 1 pound per mile of waterline. Approximately 2 miles of waterline per hour were seeded by one man walking on the lateral roadway. Seeding was done in summer on saturated soil. No seed covering was necessary. No wire agitator was needed to cause the seed to flow. A single nail hole punched in the bottom of the can was adequate for metering the seed output.

The principal problem in the use of the gravity-flow seeder is design and calibration for seed mixtures, particularly for seeds which do not flow freely.

The low-cost grass-legume seeder for use on brush-cleared rangelands, shown in Figures 14 and 15 was devised by Allen P. Johnston, manager of the Kapapala Ranch, and chairman of the Kau Soil Conservation District, Hawaii.* The seeder was developed after years of wrestling with range seeding problems. The seeder can be built at a cost of about $25, including both labor and materials.

The first seeder constructed was mounted on 4- by 4-inch timbers on the back of a large crawler-type tractor at about the same height above the ground as the driver's seat. The seeder is well suspended about 5 feet above the ground, well away from the rocks, brush, and rough terrain that so often damages the conventional drill. The seeder required few repairs, but a few slight improvements were made as the original model was put to test.

Fig. 14

The seeder box, or hopper, Figure 16, is constructed very much after the pattern of a seeder box on most conventional drills. The box is about 12 feet long and about 12 inches deep. The top of the box is 12 inches wide and tapers at the bottom to about 6 inches. The box was constructed of unplaned lumber 1 inch thick.

*A condensation from an article by Roy I. Shipley, Range Conservationist, Soil Conservation Service, Hawaii, as published in the October 1953 issue of Westland Pasture Journal.

Fig. 15

The feeder openings bored through the bottom of the hopper are about 3/4 inch in diameter and spaced 16 inches apart. The box is divided into small compartments by fitted wedge-shaped wooden dividers. The dividers prevent the grass and legume seeds from "running" to one end on rough terrain or when traveling on a slope. The wooden dividers are fastened midway between the openings.

A 1/2-inch pipe runs the entire length of the seeder box and is mounted in the top center so that the lid can be closed without binding on the pipe.

The problem of getting grass seed to flow evenly through feeder openings was overcome by the use of No. 6-gage galvanized wire, about 4 or 5 feet long. It runs through the feeder openings and is fastened at the top to the 1/2-inch pipe mounted inside and near the top of the box. The pendulum motion of the wires aids in a steady flow of seed through the openings.

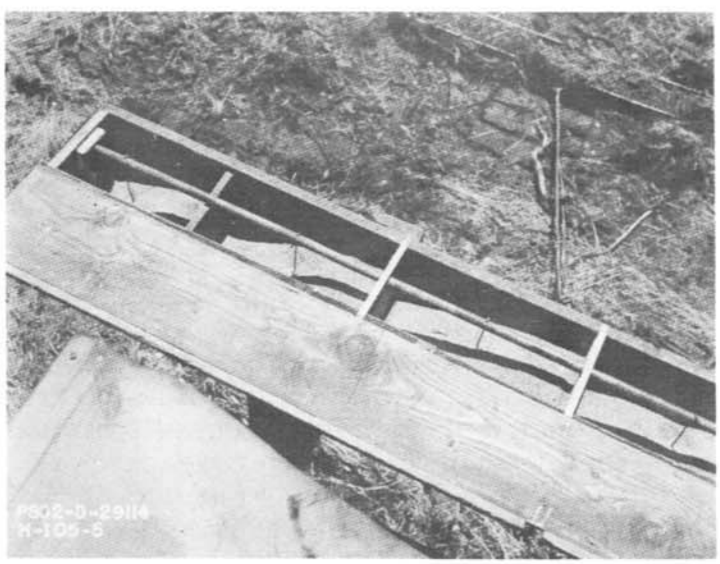


Fig. 16

In calibrating the seeder to seed the proper pounds per acre, three holes, 3/8-, 7/16-, and 1/2-inch diameter respectively and about 2 inches apart, were bored through pieces of heavy tin about 2 inches wide and 6 inches long. The 2- by 6-inch tinplates were then slipped over the wire through the size of opening desired and were fastened to the bottom of the hopper by small screws exactly over the 3/4-inch hole drilled through the bottom of the hopper.

The seeder broadcasts the seed behind the tractor. A chain is dragged behind for covering the seed. Observations of germination and stand on some of the earliest seedings show a surprisingly uniform stand of seedling. Johnson sums up the results of the seeder in this way:

> "The stand is much more uniform than when seed was broadcast by hand and there is a considerable saving in labor. Now one man is doing a better seeding job than three men were previously doing. This is accomplished by seeding and covering the seed in one operation."

Calibrating the seeder to drop enough, but not too much seed, was a stickler until Johnson hit on an idea. The gimmick was a 2-pound coffee can with a hole in the bottom large enough to slide upward over one of the wire ends hanging below the seeder. The can was then tied against the bottom of the hopper so as to catch all the seed coming through one opening.

The seeder was then operated over a distance of about 1,000 feet. Seed collected in the coffee can over this distance traveled is weighed and multiplied by the total openings in the drill. Thus it was possible to calculate the pounds of seed being applied per acre to the land. When too much seed was going through an opening, the metal plate was moved so that a smaller opening was used.

Mr. Johnson explains that the second seeder mounted on the back of a smaller crawler tractor did not seed at the same rate as the one behind the larger tractor. The speed at which the seed drops through the seeder openings is dependent upon vibration of the particular tractor and movement of the wires hanging pendulum-like below the seeder box. The seed automatically quits flowing once the machinery is stopped. The second model was speedily calibrated to seed the right amount by changing to the proper opening in the metal plate.

Seed Covering Equipment

The 14-foot length of finger weeder, a flexible spring-toothed harrow, shown in Figure 17 being lowered onto a large canal bank, was adequate for covering grass seed on the Columbia Basin Project, Washington. Seed was broadcast in front of the harrow by means of an electrically operated broadcast seeder mounted on the right front of the small crawler tractor. The center 6-foot section of the finger weeder was clamped to the tubular sidearm drawbar. End sections, each 4 feet long were hinged to the center section and were free to move over obstructions not common to the whole length of the weeder.

The finger weeder is a common type used on farm equipment, resembling a long-finger type spring-tooth harrow. A similar weeder is shown in more detail in Figure 18, where a section of the device was modified to follow a gravity-type seeder for seeding waterlines.

One of the major advantages of the combination finger weeder and seeder shown in Figure 17 is its adaptability to seeding from the

Fig. 17

Fig. 18

bottom of the slope as well as from the top. Tines lost or broken on rocky soil are replaced rapidly and at little expense.

Including a cable drum, hydraulic or electric boom lift would be an advantage in the operation of the device. The weeder produced a noticeable side draft on the small tractor used. A larger tractor would be more satisfactory.

Accessory Equipment

As shown in Figure 19, a household-type vacuum cleaner is being used to remove one seed mixture from a grain drill prior to the planting of another mixture type. A 1,500-watt, 120-volt, alternating-current portable generator has many uses in the field for driving portable electrical tools, and it was used to power the vacuum cleaner.

Fig. 19

The cleaner was used on the Columbia Basin Project, Washington, where studies were made to determine which grasses and legumes were best adapted to wasteway impoundment areas which were to receive water. Establishment of desirable vegetation was expected to retard the invasion of noxious weeds and phreatophytes onto wetted lands to which access would eventually be difficult.

Fig. 20

Sand fences as shown in Figure 20 on the Columbia Basin Project, Washington, may be employed to protect a water channel and road in preparation for seeding grass. Wind-borne soil which could cover the seed to depth and prevent germination, is deposited on the leeward side of the fence in the center of the photograph. Fence sections are approximately 3 feet high and 10 feet long, containing two attached braces which fold flat for transport. Wind velocity was reduced for a distance of approximately 30 feet beyond the fence and facilitated seeding operations.

Chemical Preventive Methods

Chemicals which prevent weed growth include the use of pre-emergence applications of herbicides, the use of copper sulfate to reduce population of algae to a low level, and soil sterilization. Many of the materials and procedures used in the prevention of weeds also are employed in their control. Equipment used in application of the materials is discussed in that portion of this bulletin devoted to control.

Soil Sterilants

Sterilization of soils is one method of chemical treatment that could be applied during construction of the canal or lateral system if conditions should warrant. In an annual report of a regional weed control program, the Irrigation Division of Region 7, Bureau of Reclamation, points to the success achieved in using soil sterilants to control weeds in laterals on the Bostwick Division of the Missouri River Basin Project.

Fig. 21

Figures 21 and 22 are of adjacent laterals. Figure 21 shows a section of a lateral not treated with the sterilant, while Figure 22 shows the condition of the adjacent lateral on June 14, 1956, that had been treated with soil sterilant during the period April 30 to May 15.

About 30 miles of laterals were treated with soil sterilant in 1956. An area about 8 feet wide in the wetted perimeter of the lateral was treated. It was mixed with water and applied at the rate of 12 pounds per acre with a specially designed hand boom.

Fig. 22

The boom was operated by a man walking in the bottom of the lateral.

The chemical was applied, as stated previously, between April 30 and May 15, after all dry weeds had been burned out of the laterals and they had been cleaned with a ditcher, where necessary.

Excellent results were obtained. No broadleaf weeds or weedy grasses were observed before July 15. After July 15, a few weedy grasses were observed; however, they were sparse and obtained only limited growth which caused no operational difficulties.

The Region feels confident that the sterilization of the wetted perimeter of laterals has cut down operation costs, reduced the amount of water lost by transpiration and reduced silt deposits in the bottom of laterals. Heavy silt deposits in untreated laterals greatly reduced their capacity.

Sodium Chlorate and Safety

The use of sodium chlorate as a weed sterilant or weed control material is not generally recommended because of its dermatitis and fire hazard problems. If used, sodium chlorate and other chlorate weed-killing compounds should be handled with extreme caution. The following precautions should be rigidly observed:

1. Sodium chlorate should not be permitted to come into contact with the skin or the eyes. If it gets on the skin or in the eyes, the chemical must be removed immediately by thoroughly flushing the surfaces with water.

2. Sodium chlorate should be stored in tightly covered metal containers. The containers should never be opened in buildings, or placed in fields where there is any livestock.

3. Should sodium chlorate be spilled on the clothing, such clothing, since it constitutes a dangerous fire hazard when dry, should immediately be removed and thoroughly washed. Rubber boots and gloves should be worn by workmen when spraying with the chemical.

4. A person should not be permitted to walk or ride, or to move equipment of any kind through treated areas, and livestock should be kept out of such areas until after a heavy rain, as even slight friction is likely to ignite the vegetation and cause serious fire damage. Areas near buildings where fires might result in loss of life or property should not be sprayed. Smoking should be prohibited while applying sodium chlorate or while working around sodium chlorate containers, equipment, or treated areas.

Weed Exclusion Devices

Equipment for mechanical exclusion of seed and plant parts capable of reproducing the plant may be screens, weed traps, diverters within the water channel and livestock fences. They exclude the weeds themselves or the agencies which carry the weed propagating parts of plants onto the rights-of-way and into the water channel. The use of many of these devices is closely associated with weed disposal and is discussed in more detail in that portion of the bulletin devoted to this subject.

Weed Seed Screens

Weed seeds do enter farms through irrigation water, and screens have been developed which will remove seeds of the most important weeds. For simplicity, low cost, and ease of maintenance, a flat, horizontally mounted screen, Figure 23, appears to fill the requirements.*

If the irrigation system has a drop, the flat screen shown placed at the farm turnout can be used. The flat screens have a frame, Figure 24, with screen stretched across it and a box, Figure 25, which holds the screen frame. The box usually has high sides to control splashing and provides for overflow. The action of the water falling onto the screen causes vibration. The swirling water then pushes the trash and seeds to the sides of the screen.

NOTE: *Condensation from a publication "Weed Seed Screens for Irrigation Systems," prepared by Walter Bergstrom, County Extension Agent, Grant County, Washington. This extension circular may be obtained at county offices or at State offices in Pullman, Washington, Corvallis, Oregon, or Moscow, Idaho.

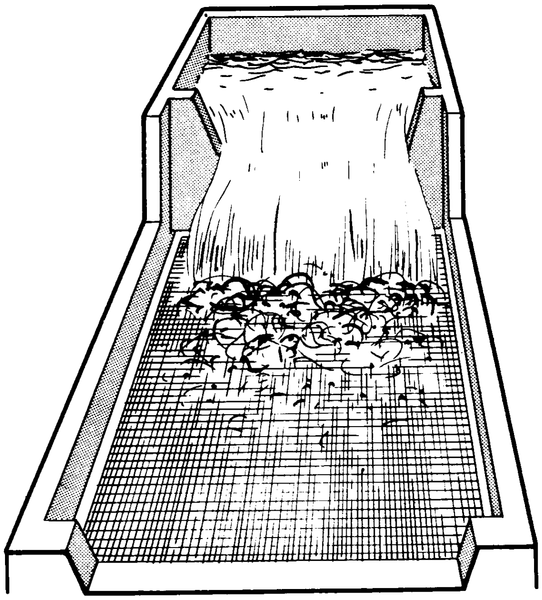


Fig. 23

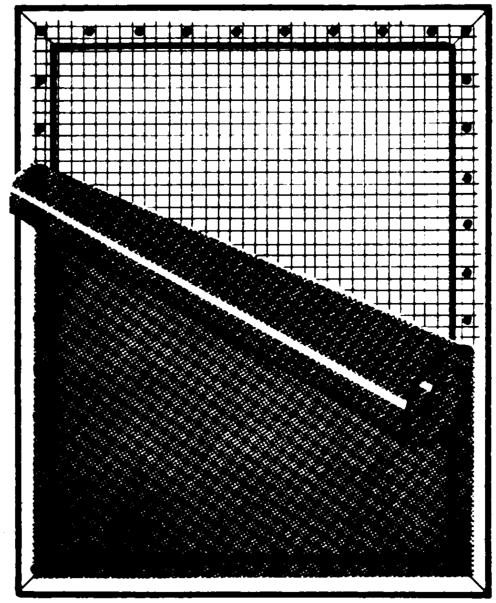


Fig. 24

Screens of this type are available commercially in several sizes. They are usually constructed of metal. However, a serviceable screen can be constructed; and if constructed, a rigid frame of 2 by 4 lumber is recommended so that there will be little chance of sagging or warping. Since most screen material is 3 feet wide, this is a good width for the frame. The length will vary with the size needed to fit the particular site. The frame should be constructed to fit snugly in the frame box. It is not fastened to the box since its removal may be necessary. From 6 to 8 square feet of screen area is used for each second-foot of water flow.

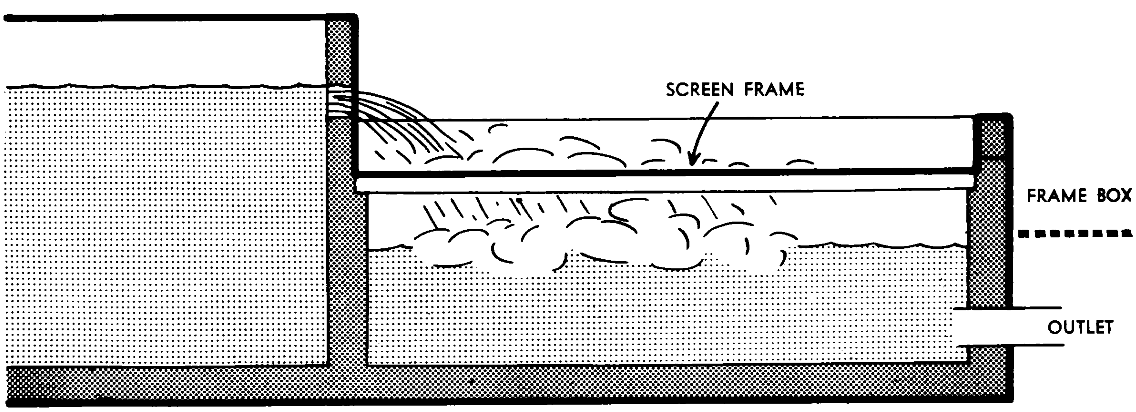


Fig. 25

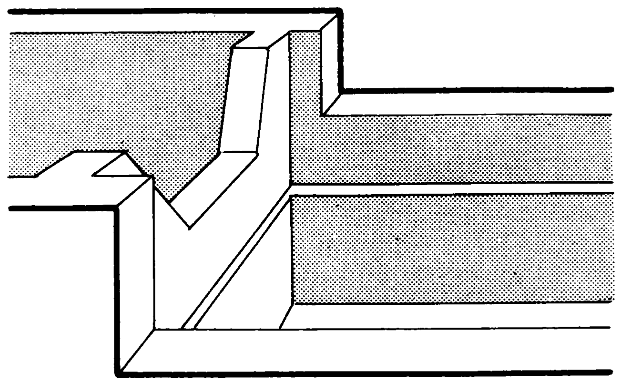


Fig. 26

The actual screen is made up of two layers--a support screen on the bottom and a fine screen on the top. The support screen, 1/2-inch mesh galvanized hardware screen, is stapled to the frame first. The fine screen, Nos. 40 to 60 mesh, is then stapled on top of the support screen. The Nos. 40 to 60 mesh screen is fine enough to screen out nearly all varieties of weed seed. To prevent corrosion, the fine screen should be of nonmetallic material--either saran plastic or fiberglas. Both resist acid, alkali, and electrical corrosion.

In stapling the screens to the frame, it is absolutely essential to get them "drum tight" so that they will vibrate with the action of the falling water. This will bounce the sand and silt particles and the swirling water will move them across the screen.

Many variations are possible in the frame box. Basically, it holds the screen frame below the farm turnout and includes provisions for leading the water into the farm ditches or pipelines. Boxes vary from simple posts at each corner of the screen frame to elaborate poured-concrete structures, Figure 26. The downstream end of the box is left open for easy cleaning. The sides should be at least 6 inches high to prevent splashing and overflow.

There should be some clearance between the screen and the water below it. Bubbles touching the screen reduce the flow of water through the screen. Screens work best when they are level. Tilting creates problems. With pipe turnouts or flumes, the water must be directed so that it will be discharged above the screen. This may require construction of a pooling box and weir.

The more screen area the water hits as it falls, the less drop needed. Increasing the width of the waterfall will lessen the amount of drop that is necessary, and flat screens can be used with as little as 3 inches of drop, if a device is added to create agitation. This aids the movement of the water through the screen.

Agitation may be created by an undershot water wheel, by wedges placed on the screen to divide the water or by boards or small fluming apparatus that divide the water and drop it onto the screen in several positions.

The coarser screens, Nos. 40 to 50 mesh, may accumulate angular sand particles, if any are present. The fine mesh apparently permits the grains to bounce away.

Plastic screens may become clogged with diatoms, single-celled algae, slime molds or bacteria. An occasional wash with a 5 percent (1 pound in 2 and 1/2 gallons) solution of copper sulfate will usually remove the slime.

The cost of a flat weed screen may range from $10 to $100, depending upon the size, construction necessary to accommodate the screen and construction materials used. Flows of 1 to 7 cubic feet per second have been efficiently handled with one screen. Larger flows may be handled by multiple screens installed side by side.

Typical of a one-screen installation is the metal-framed seed screen placed below a turnout structure on the Kennewick Division of the Yakima Project, Washington, Figure 27. Weed debris covers about 40 percent of the screen. Unless removed, the debris would be pushed off the structure onto the ground. The barrel in the background is used to store debris from the screen before it is dried and burned.

Fig. 27

A multiple screen installation on the Columbia Basin Project, Washington, is shown in Figures 28 and 29. Each of the screens shown in Figures 27 through 29 are commercial units, and the debris collected may be an accumulation of several days.

Fig. 28

Flows of water greater than 10 cubic feet per second can be screened effectively provided disposal of the seed is possible and provided a rather high initial cost and operation cost can be justified.

At a still higher cost, presumably, the screens could be designed for fully automatic

Fig. 29

operation. The estimated cost of installing a screening plant of the simplest type to handle the flow of water to 6 farms was more than 10 times the cost of permanent installations on each farm delivery system. In addition, operation would have required at least 2 man hours per day to clean the screens and dispose of the debris.

Screening of the larger flows may be more practical where municipal and industrial water users cannot tolerate the small amount of living and dead debris present in the raw water. Such an installation was made at the water screening plant of the City of Ephrata, Washington, Figures 30 and 31. Two of the flat farm-type screens were installed to remove the small debris from the canal water the city uses to supplement their well water supply during the summer. Mr. Peder Hemstead, City Engineer, designed the plant.

Many other types of weed screens have been developed and used. They include V-shapes, tubes, bags, and electrically operated drums.

Fig. 30

The use of "water-sock" screens and vertical screens is described by Walter Bergstrom, County Extension Agent, Grant County, Washington, in his previously cited publication. They can be used in irrigation systems that do not have a drop.

This type of screen, Figure 32, is simple and economical to build since it requires no framing or boxes for installation. However, sock screens are limited to sites where algae and moss are not a problem.

Fig. 31

Sock screens can be made from No. 40-mesh saran plastic filter cloth or similar flexible material, with two 3-foot pieces stitched into a tube. The length varies with the amount of water to be screened. A sock 10 feet long will have an effective screen area of about 60 square feet, and should handle a flow of 3 second feet of water since the requirement is 18 to 24 square feet of screen for each second-foot.

A drawstring is sewn to each end and permits the sock to be opened and closed for attachment to a pipe or other submerged outlet and cleaning.

Because of its length, the lower end can usually be removed from the stream and cleaned without disrupting the water flow.

The vertical screen is nothing more than a flat screen set on edge, Figure 33. Its use is limited because it has no self-cleaning action. Therefore the screening area must be very large--usually three times the area of the standard flat screen. This means about

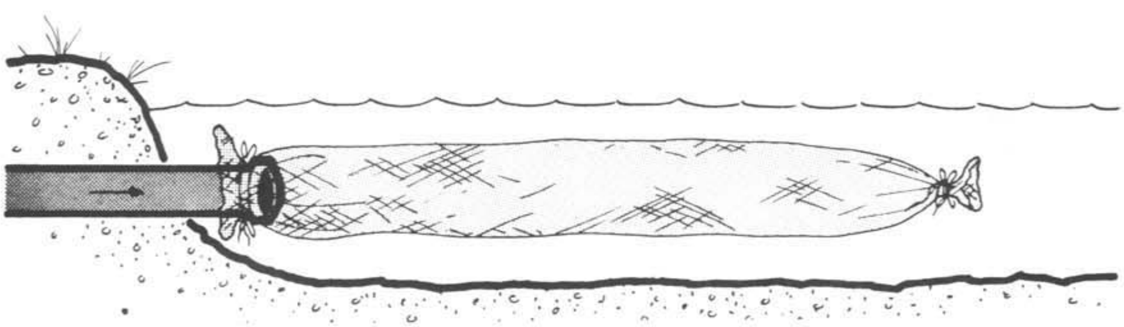


Fig. 32

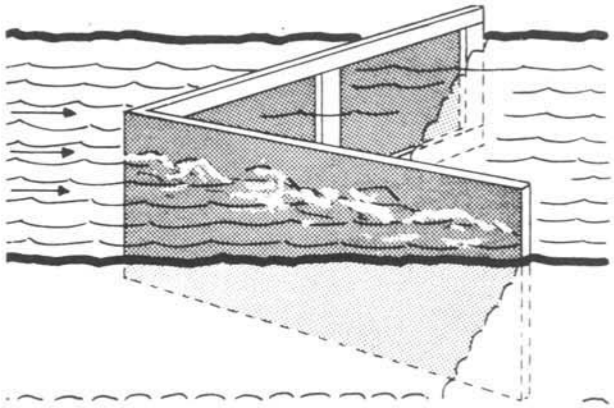


Fig. 33

18 to 24 square feet of screen should be allowed for each second-foot of water flow.

Most vertical screens are in the form of an A-frame 10 to 12 feet long on each side. Construction is very similar to that of flat screen frames with double layers of screen stapled to a wooden frame. A box of rocks or another weight placed on the top holds the screen in place. The edges are buried in the ditch side to make a tight seal.

Drawbacks to vertical screens presently used are undermining and washing around the wings and difficulty in cleaning. These problems can be avoided by using a diagonal screen, instead of an A-frame screen, and incorporating it with a concrete check. Also, a stilling basin along the side of the ditch can be used to divert the trash.

There are other solutions for systems with no drop.

Where no fall is available, a low-lift pump may be used to lift water from the weir pool to a height of a foot or more and drop it onto a flat screen. This increases the cost of screening weed seeds, but still may be a low-cost weed control measure.

Fig. 34

Weed screens available from commercial builders will screen water in the absence of fall. These vary from rotating wire barrels to endless belt-type screens. Here again the cost of the screening installation goes up, but the cost of the installation may be much below the cost of weed control.

A bag-type weed seed screen designed and constructed by a Columbia Basin Project farmer for attachment to a weir structure is shown in Figure 34. The metal frame at the mouth of the bag was constructed to intercept the water without interfering with the weir as a measuring device. The bag was made of saran, a plastic filter screen containing approximately No. 40 mesh per square inch. Seams were sewn with nylon thread.

CONTROL OF LAND WEEDS
Pasturing of Canal Rights-of-way

Pasturing of ditchbanks is an accepted and practical method of controlling weeds and utilizing forage along irrigation ditchbanks and on adjacent rights-of-way. However, proper control of the livestock requires fencing, and unless cattle guards are installed the ditchriders are confronted with the delaying chore of opening and closing gates. The cattle guards may be of the conventional type as shown in Figure 35, or some special type discussed on the following pages.

Cattle Guards

There is a considerable difference of opinion among O&M and other project personnel regarding the design of cattle guards on canal-operating roads. In the interest of economy, many feel that the number of cattle guards installed on our canal-operating roads can be reduced. Nevertheless, it is agreed by all that cattle guards are a definite need under certain circumstances and especially serve a vital purpose in expediting travel through stock-raising country.

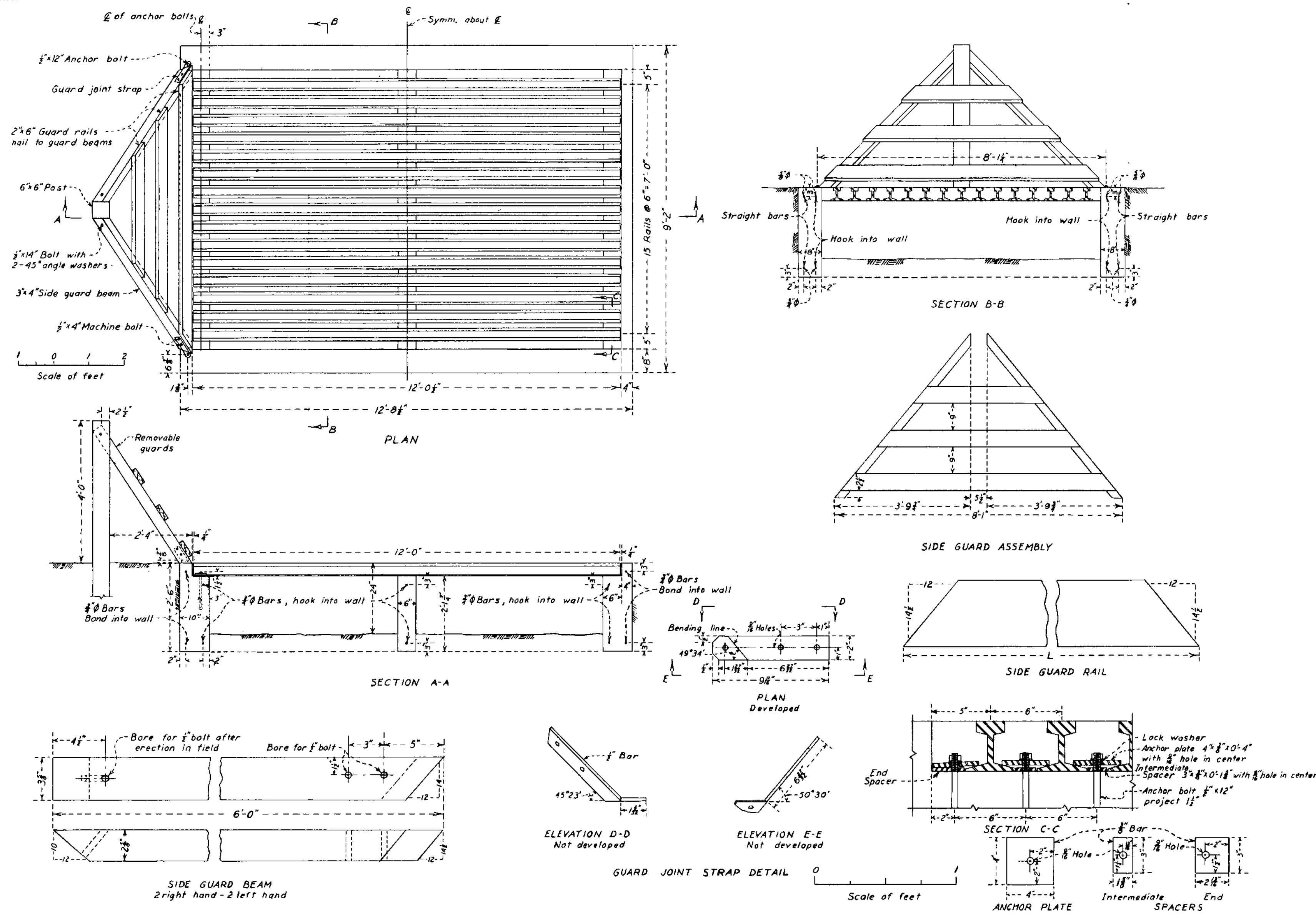
Most field offices report that where cattle guards have been installed in accordance with the Bureau's standard design, Figure 35, they have given generally satisfactory service, except where exceptionally heavy traffic must be accommodated. The principal objection by most field people to the standard design is the cost of construction. On the other hand, it is pointed out that from an O&M standpoint, the original cost may not be the important cost.

Fig. 35

The present high cost of lumber and labor and the short life of wooden structures may prove that an even more costly design, one calling for concrete and steel construction, as shown in the Drawing, Figure 36, is less expensive over a period of years because of lower maintenance and replacement cost. In this regard, it is interesting to note that although many object to the original cost, there is a tendency in replacement and repair of cattle guards to use steel and concrete construction in an effort to reduce replacement and maintenance costs in the future.

In accordance with the above, design of a cattle guard should embody features that will result in lowest possible cost for materials, labor, and construction, as well as maintenance and replacement. Some of the more specific suggestions and recommendations for cattle guard designs are:

1. One design standard for cattle guards will not meet the requirements for all projects or operating conditions.
2. "Bed-spring" type cattle guards, wire gates, or "bumpgates" can be used in some locations in lieu of the more costly cattle guards.
3. Commercially available, prefabricated cattle guards should be installed wherever possible. They are manufactured in quantity and, therefore, are less costly.
4. Narrower and less costly cattle guards could be installed on canal-operating roads for passage of light traffic, providing adjacent wire gates for the passage of heavy equipment and traffic.
5. Where the more costly type of cattle guard must be used, specify as many similar guards as possible in one contract to take advantage of mass production and resulting lower cost.
6. Eliminate the 24-inch pit under deck of the cattle guard by using heavy railroad rails, or by setting the stringers of the cattle guard deck level with the roadway and ramping the roadway over the structure.
7. Provide guard posts adjacent to cattle guards to eliminate damage by the passage of wide equipment over it or to prevent equipment for approaching the cattle guard at an angle.
8. Avoid placing a cattle guard on a sharp curve. It is difficult to approach in a manner that permits traffic to move through it without damage to wing guards.



BILL OF MATERIAL

NO. REQ'D	DESCRIPTION	DIMENSIONS
2	Post	6"×6"×7'-0" s4s
4	Side guard beam	3"×4", L=6'-0" s4s
2	Side guard rail	2"×6", L=7'-9" s4s
2	Side guard rail	2"×6", L=5'-9" s4s
2	Side guard rail	2"×6", L=3'-9" s4s
12	Rails	60 lb. ASCE, L=12'-0"
28	Spacer bar, inter.	3"×⅜", L=1⅜"
4	Spacer bar, end	3"×⅜", L=2$\frac{11}{16}$"
2	Machine bolt & nut	½"×14"
4	Angle washers	½"-45°
8	Machine bolt & nut	½"×4"
8	Plate washer	½"
32	Anchor bolt & nut	½"×12" Galvanized
4	Guard joint strap	2"×¼", L=9$\frac{11}{16}$"
1#	Nails	20d common
32	Anchor plate	4"×⅜", L=4"
6	Rails	60 lb. ASCE, L=6'-0"
6	Rail splice bars	24" long for 60# rails
12	Splice bolts, nuts, & washers	¾"×4" for 60# rails
32	Lock washers	½"

ESTIMATED QUANTITIES
(For one cattleguard)

Concrete	3 C.Y.
Structural steel (Used rails)	3600 lbs.
Reinforcing steel	300 lbs.
Miscellaneous Metal	220 lbs.
Timber	100 FBM

NOTES

Where the bank width is less than 14 feet use longer posts.
Lumber to be cut to dimensions given ±⅛".
Side guards and portion of posts above ground to be painted white - 2 coats after installation.
Concrete to be placed on undisturbed earth or compacted fill.
Short lengths of rail to be spliced over center support with standard rail splice bars.
Rails to be cut from 30 ft. - 60 lb. ASCE used rails.
Side guard posts to be either redwood or treated.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL VALLEY PROJECT - CALIFORNIA
MADERA CANAL
CATTLE GUARD FOR OPERATING ROADS

DRAWN EHL — SUBMITTED
TRACED — RECOMMENDED
CHECKED — APPROVED

F11008-C | FRIANT, CALIFORNIA | JAN. 5, 1950 | 214-219-11008

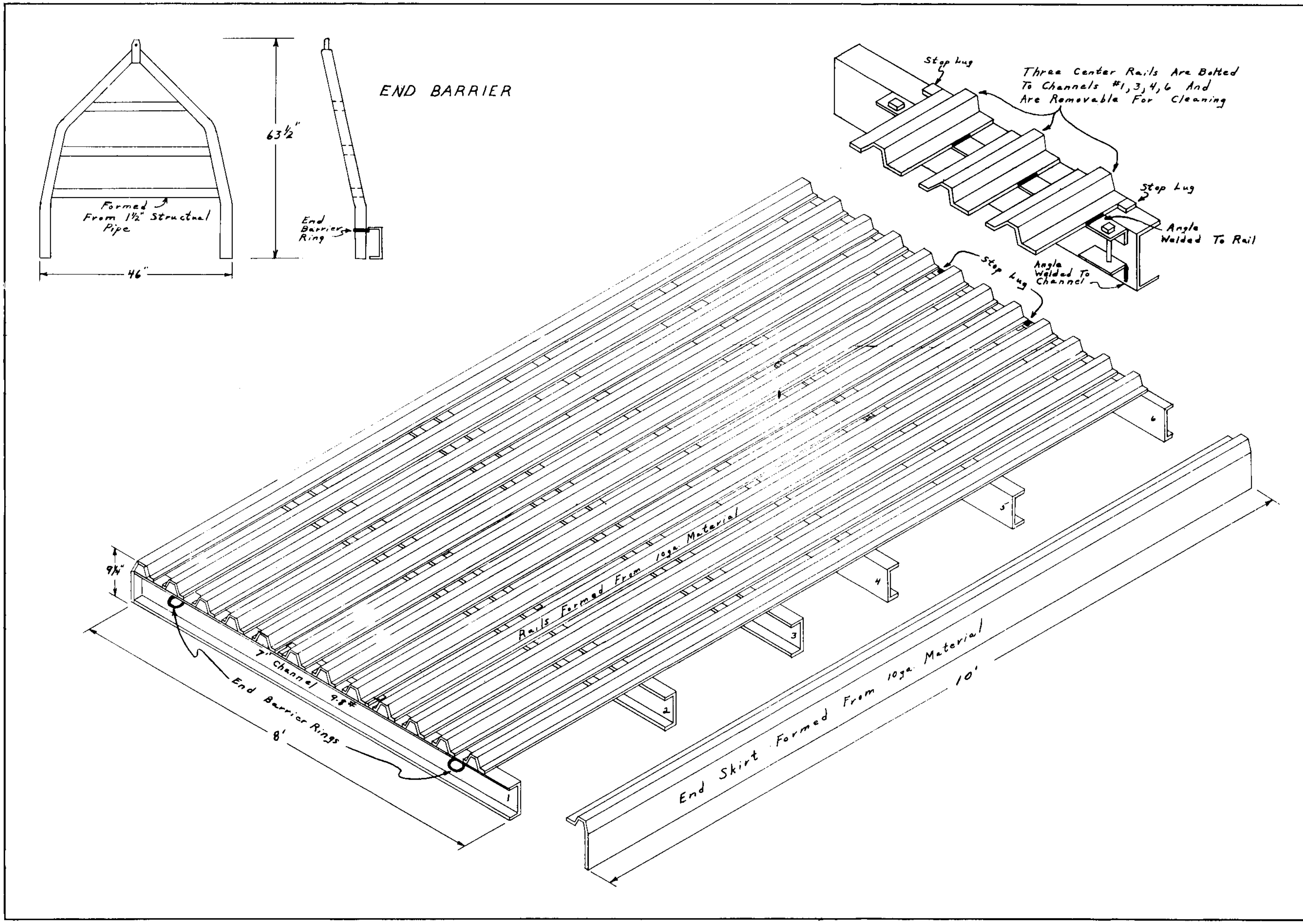
9. Use lighter material in construction of wing guards, 1-inch instead of 2-inch material.
10. Fabricate wing guards separately and provide for tying them to the guard posts and surface-guard framing by metal strips and bolts or lag screws.
11. Avoid use of mesh-type decking material for cattle guards. Much difficulty has been encountered in breakage of the unsupported mesh.

There are other low-cost cattle guards available such as the "auto-gates" manufactured on a commercial basis, as shown in the drawing, Figure 38. These are being used extensively on some of our midwestern projects in Nebraska and Kansas.

In the March 1953 issue of the Reclamation Era, Mr. Theodore Nelson, Chief, O&M Division, Region I, illustrated and discussed a practical, cheap, portable cattle guard fabricated from light metal strips and small coil springs, mounted upon a tubular frame, Figure 37. Several field offices believe the device especially practical and easily made standard with a few improvements. If, under constant use, annual replacement might be necessary, however, its original low cost may offset this. It appears the "bed-spring" cattle guard would be satisfactory for an installation which accommodates traffic at low speeds and of limited weight.

The Kittitas Reclamation District is using a spring-suspended grill made of surplus steel landing mats for a guard, Figure 39. The

Fig. 37


END BARRIER
Formed From 1½" Structual Pipe
46"
63½"
End Barrier Ring
Stop Lug
Three Center Rails Are Bolted To Channels #1, 3, 4, 6 And Are Removable For Cleaning
Stop Lug
Angle Welded To Rail
Angle Welded To Channel
Stop Lug
9¼"
7" Channel 9.8#
End Barrier Rings
8'
Rails Formed From 10ga Material
1
2
3
4
5
6
End Skirt Formed From 10ga Material
10'

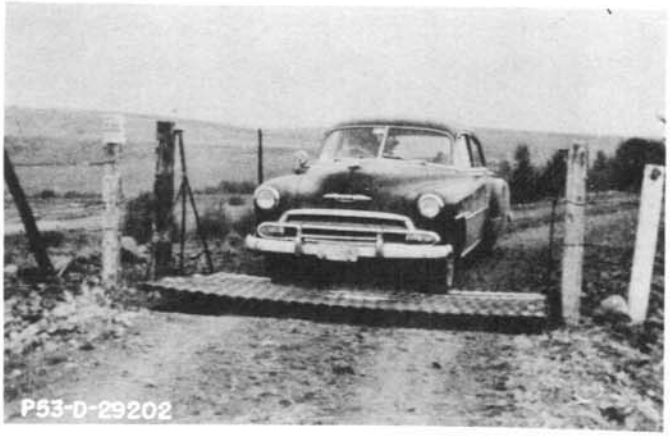


Fig. 39

inexpensive war surplus landing mats are suspended 3 to 4 inches above the ground by use of a single spring on each side of the 90- by 120-inch mat. The springs, which are only 10 by 1 inch in size, connect a triangularly braced strap iron, welded to the mat, with the top of a side post. A guide is attached at the base of each post. Thus the mat is permitted to move only in an up and down position. Use to date is limited and the Project believes some improvements may be needed. However, the cost of construction and installation is substantially less than the conventional pit-type guards.

A range cattleguard constructed of rubber strips and wires on the Columbia Basin Project, Washington, is shown in Figure 40. The wires carry an intermittent charge from a battery-type electric fence charger. This cattleguard appears to be effective against livestock. In more populated areas, it would be a hazard to children. The wires, being under tension may be pulled loose by automobiles which cross too rapidly.

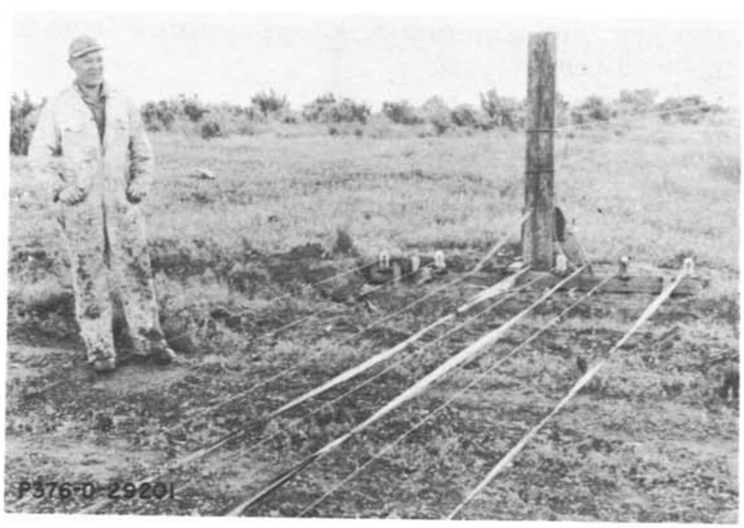


Fig. 40