BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G95.400.1
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RYAN WIRE AND CABLE PLOW

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1. GENERAL

1.01 This section describes two models of Ryan Wire and Cable Plows, Models B and C, and outlines their operation, maintenance and precautions essential to safe operation.

1.02 The two models of Ryan Plows are similar in design and are capable of placing underground wire and any type of cable that is suitable for use in buried cable applications.

1.03 Precise control in raising and lowering the plowshare is provided by means of two hydraulic gasoline engine powered jacks, one mounted on each wheel. Independent operation of these jacks affords the operator a means for controlling the depth of cable placing as well as maintaining vertical share alignment when plowing along ditches, roadside slopes, etc.

1.04 Maximum plowshare depths, cable placing capacities, and weights of the Ryan Model B and C plows are shown as follows:

Model	Max. Depth of Plowshare (Inches)	Max. Diameter of Cable (Inches)	Approximate Weight (Pounds)
Ryan B	36	1-1/2	4,000
Ryan C	42	2-3/8	6,000

1.05 The tractive effort required to pull the plowshare through the soil varies with the soil conditions encountered. Accordingly, it is important that the equipment assigned to pull the plow have ample reserve power to permit steady plowing. In average soil conditions, the equivalent of one D8 Caterpillar tractor provides ample pulling power.

1.06 Speed of plowing should be governed by conditions but, in general, should not exceed about 150 feet per minute.

1.07 For conditions where the pulling vehicle can not negotiate, a winch may be used to pull the plow.

1.08 The operation, maintenance, and precautions essential to safe operation of the small 4-cycle gasoline engine are outlined in another section of the Practices.

2. SAFETY PRECAUTIONS

2.01 The signals used to indicate various operations should be thoroughly understood by all involved and should be reviewed as often as necessary to ensure that everyone is familiar with them.

2.02 Only the employees required to perform the work should be on or near the plow, the trailer or the pulling vehicle.

2.03 Close signal coordination between the pulling vehicle operator and the plow operator is necessary in order to stop the pull as quickly as possible when adverse plowing conditions are encountered.

2.04 When handling the cable reel trailer and winch rope observe the precautions outlined in other sections of the Practices.

2.05 The towing pin should always be in place when the plow is towed behind a truck on a highway.

2.06 Be sure the towing pin has been replaced by the shear pin before plowing operations are started. If the towing pin is used during plowing, serious damage to the plow may result.

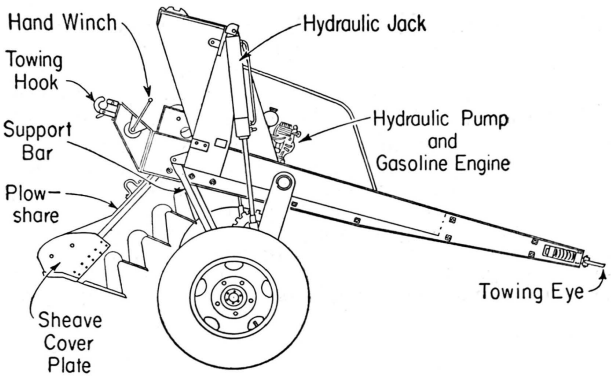
2.07 The plow operation should be under constant observation for ground obstructions and any indication of improper operation of the plow or the feeding of wire or cable.

2.08 The plow should be started slowly to avoid undue stresses on the equipment.

2.09 When plowing avoid sharp turns which will place excessive stress on the plowshare and plow carriage.

3. DESCRIPTION

3.01 The following illustration shows the general appearance of the Ryan plow and indicates the essential parts which may be required for replacement purposes:

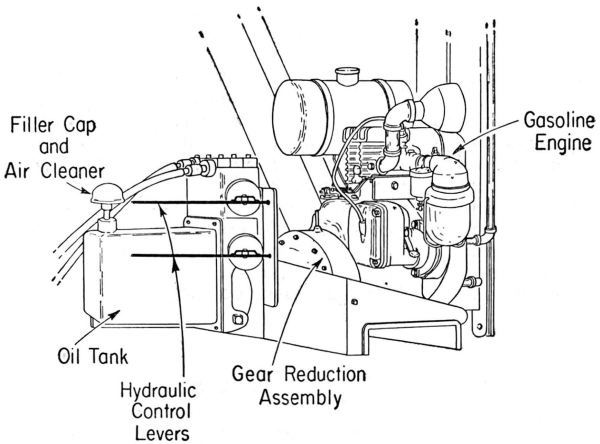


RYAN WIRE AND CABLE PLOW

3.02 The Ryan plow consists primarily of two main frame channel irons, a plowshare mounted within the framework, and vertical frames on each side for supporting two hydraulic cylinder jacks, one mounted on each wheel. The vertical frames also serve as a support for a sheave and axle assembly for guiding wire and cable into the feeding tube of the plowshare. A notched coulter wheel is located ahead of the blade and is hinged with a spring mechanism to permit it to raise over solid obstructions. The tongue of the carriage is equipped with a spring cushioned towing eye for attaching the plow to the towing vehicle. A towing hook is provided at the rear of the plow carriage for attachment of a cable reel trailer. A hand winch located just behind the towing hook can be employed to assist in connecting loaded cable reel trailers or replacing the plowshare.

3.03 A 4-cycle gasoline engine mounted on the main frame over the wheels provides the power necessary to operate the hydraulic system. The engine is governed at 2400

rpm and at this speed develops about 3.4 HP. A 2 to 1 gear reduction assembly is used to reduce the power take-off speed to 1200 rpm for driving the hydraulic pump.



3.04 A double acting, vane type, hydraulic pump transmits power through oil under pressure for operation of the hydraulic cylinder jacks. The hydraulic system is set at 1000 pounds per square inch pressure with each jack having an 8000 pound lift. A relief valve is provided for limiting pressure where the plowshare may be held fast on some underground obstruction. The plow may be backed up slightly only if it is absolutely necessary to facilitate raising the blade over the obstruction.

3.05 Two side support bars are provided for bolting the wheels in the raised position in order to take the weight of the plow off the hydraulic jacks when not in use. See Paragraph 3.01. The bottom of the plowshare is thus raised sufficiently above the ground level for towing from one location to another.

3.06 The plowshares on both models are provided with two ball bearing sheave wheels at the lower end of the wire and cable feeding tube and bronze bearing cable guide sheaves at the upper end. The cable guide assembly is adjustable for the various size cables to be buried. A removable 3/4-inch I.D. stainless steel pipe, if ordered with the plow, is bolted on the rear side of the plowshare to serve as a shield wire feeding tube.

3.07 A spindle bar is furnished with the plows for supporting small wire and cable reels. Where cable reel trailers are used, it will be necessary to guide the wire and cable over a sheave assembled on the spindle bar. An empty wire, strand or small cable reel is satisfactory for a sheave guide as long as it rotates freely and has a drum diameter which permits the cable to be fed reasonably straight into the plowshare feeding tube.

3.08 On Ryan Model C plows, two removable wheel arm angle stops on the main frame limit the plowshare depth to 36 inches. Removal of these stops permits a maximum plowshare depth of 42 inches and reduces the main frame ground clearance from 8 inches to 2 inches.

4. PREPARATION BEFORE USE

4.01 Check the hydraulic system for tight fittings and make sure the oil tank is properly filled with light hydraulic oil (not hydraulic fluid) having a viscosity in the range of 150-225 S.S.U. at 100° F. Hydraulic tank should be full when the pistons are at the top of the cylinder jacks.

4.02 Prepare the gasoline engine for use in accordance with instructions outlined in the Practice covering small 4-cycle gasoline engines. Fill the gear reduction case with clean motor oil of the same grade (S.A.E. 20 or 30) used in the gasoline engine crankcase. The case should be filled to the level indicated by the oil level plug located on the side, slightly above the bottom.

4.03 Start the gasoline engine and operate the hydraulic levers to raise the plow in order to take the weight off the bolts in the side support bars. Do not operate the control levers when the engine is stopped as air may enter the hydraulic system.

4.04 Remove the lower bolts in the side support bars attached to the wheel arms and swing the bars upward to the top of the vertical frames. Replace the bolts in the bars and lugs on the vertical frames. The plowshare is now free to be raised and lowered by the hydraulic jacks.

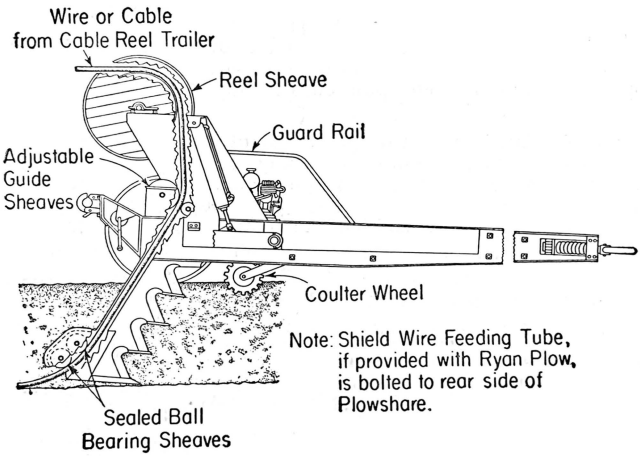
4.05 Inspect the sheave assembly mounted on the side supports of the plow to see that the reel rotates freely.

4.06 Make certain that the pulling vehicle and cable reel trailer are properly fastened to the plow. Mild steel machine bolts of the following diameters are satisfactory for use as shear pins:

Ryan Model B—5/8-inch diameter bolt
Ryan Model C—3/4-inch diameter bolt

5. OPERATION

5.01 Thread the underground wire or cable down into and through the feeding tube of the plowshare until it protrudes from the opening at the bottom rear side. If necessary adjust the guide sheaves at the top of the plowshare to hold the cable at the back side of the tube. Pull out about 5 feet of wire or cable or as much as is required for splicing, termination, etc. If shield wire is required, feed the wire through the shield wire feeding tube with sufficient excess length (5 feet or more) for splicing. The path of the wire or cable through the plowshare is shown in the following illustration:



5.02 Before attempting to pull the cable plow it will be necessary to hold the end of the wire or cable until a sufficient length has been plowed to prevent the free end from moving along with the plow.

5.03 With the plowshare resting on the surface of the ground or in the bottom of a trench or pit, alternately operate the hydraulic control levers so as to place the weight of the plow on the plowshare point.

5.04 Start pulling the plow slowly forward and as the plowshare feeds into the earth, alternately lower the wheel jacks until the plowshare has reached the desired depth. Alternate operation of the jacks permits the operator to maintain a vertical share alignment.

5.05 When heavy ground obstructions are encountered, the plow should be stopped to permit the operator to raise the plowshare a sufficient amount to pass over it. With experience, the operator can "feel" the bottom of the plowshare over obstructions provided sufficient cover remains on the cable. In some instances it may be necessary to raise the plowshare completely out of the soil in order to pass over an obstruction. Hand trenching will then be required to bury the cable to the desired depth and care must be taken to leave enough slack in the cable to get around the obstruction and to avoid damage to the cable.

5.06 At terminal, loading, lateral locations, etc., the required amount of slack can be pulled through the feed tube by lifting the plowshare out of the ground. Excess cable should be located where cable reel trailer and other vehicles will not cause damage.

5.07 Care must be exercised by the operator when plowing on steep slopes, such as along roadside ditches. Even though the plowshare can be maintained vertical and the plow carriage horizontal, steps may be necessary to prevent upsetting the cable reel trailer and pulling vehicle.

5.08 Running the wheels of a heavy vehicle over a plowed length is usually adequate to close the slot.

6. MAINTENANCE AND LUBRICATION

6.01 Pulling the plowshare through the soil results in abrasion of the plowshare cutting edges, tips and wear plates.

6.02 Worn tips and edges can be built up by welding the necessary metal in place and then cutting them down to the approximate original dimensions.

6.03 Worn lower sheave wheel cover plates can be fabricated and replaced in local shops.

6.04 The two lower sheave wheels at the bottom of the plowshare have two sealed ball bearings each and do not need lubrication. The upper cable guide sheaves have bronze bearings with grease fittings and, therefore, require periodic lubrication.

6.05 Use kerosene for cleaning the cable feeding tube and sheave wheels.

6.06 In general other moving parts of the plow such as the hand winch assembly, hydraulic jack pivots, etc., should be lubricated at least once each month with a light grease or engine oil.

6.07 The 5 bolt trailer wheels with offset rims should normally be inspected and lubricated at least once each year after the plow is put in service. After cleaning the bearings, a small amount of wheel bearing grease should be spread throughout the bearings. Do not pack the hub as excessive lubrication results in grease leaking out through the grease retainer and picking up dirt and foreign matter which may work back into the bearings.

6.08 Clean the hydraulic pump air cleaner in a solvent at least once every month with normal operation. In dusty locations more frequent checks and cleaning may be required to maintain a clean hydraulic system.

6.09 Check the condition of the hydraulic oil every three months and change as necessary.