

Machines for Marshland Ditching

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ABOUT THIS REPORT

Draglines and bulldozers can take care of major repairs to the dikes and channels that protect the marshlands of the Bay of Fundy, but this heavy equipment is not suitable for cleaning the smaller ditches or for routine maintenance. This is why the Marshland Drainage Committee was set up to see whether machines could be found that would be useful to the dikeland farmers of Nova Scotia and New Brunswick.

In this report, the committee gives a brief account of the soil, the terrain, the dikes and ditches, and the drainage problem. Nine machines were tested and are described in the main section. These machines have special uses and you should discuss your needs with provincial agricultural engineers before ordering any of them.

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THE LAND AND THE PROBLEM

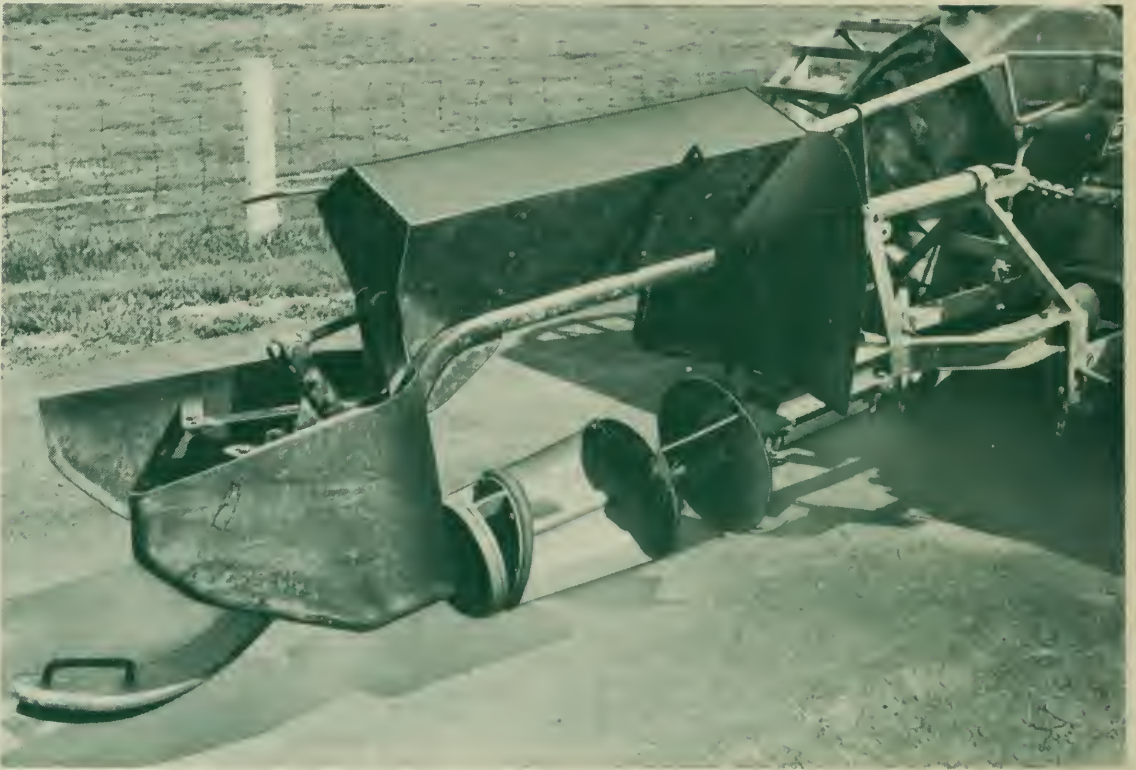
On the 90,000 acres of valuable dikeland in the Bay of Fundy area, machines are needed to maintain the dikes and ditches properly. This land consists of silt beds deposited by high-rising tides through the ages. The sea has built up the silt beds so high that they are no longer covered by the average high tides, although the peak high tides still flood over them. The marshes were first diked for cropland by the pioneer settlers of Nova Scotia and New Brunswick, and farming methods, economics and the labor supply have changed since the early days. Farmers must now use machines to keep the dikes and ditches in constant repair or surrender this land to the sea.

The silt, eroded from the soils and rocks that surround the Bay, has a variety of textures. Where the tides flow rapidly, the coarser particles are dropped; as the rate of flow slows down, progressively finer particles settle. A typical marsh area contains 15 percent clay, 70 percent silt loam and 15 percent sand. This makes a fine-textured soil that drains poorly, but it has no stones or compacted layers to obstruct ditching machinery.

The tides have deposited the silt in flat areas that slope gently away from the shores and riverbanks. Runoff water flows to the uplands and along the edges of them to the tidal creeks, which run through the silt beds to the rivers or the sea.

Because there is almost no internal drainage, most of the water is removed by evaporation and surface runoff, or by two kinds of open ditches. First there are the field, or dale, ditches that run parallel to each other down the natural slopes. These empty into the second type, the lateral, or main, ditches that carry the water to the aboiteaux outlets. The main ditches along the headlands also take surface runoff or subsurface flow from the uplands.

The early settlers laid out the land in narrow strips (dales) separated by ditches. The width of the dales varied, but the most common width was one chain. They were divided lengthwise by two, three or even four ridges. Cross-ditches allowed the water impounded by the ridges to escape into the dale ditches.



The Bahrs field ditch machine, showing the cutting and cleaning mechanism.

Tests made by the Experimental Farm, Nappan, and confirmed by marshland owners show that wide, slightly crowned dikes combined with shallow and well-sloped ditches provide adequate drainage.

Maintaining the Dikes and Ditches

Originally hand labor was used to build and maintain the dikes and ditches, but when this became economically impractical many of the dikes were breached and much land was flooded. The Maritime Marshland Rehabilitation Administration built new dikes and main drainage channels, but marshland farmers still need to keep the ditches open and carry out general maintenance. Without machines to do the job, the dikelands were in danger of being neglected again, so the Marshland Drainage Committee entered the picture in 1959. The committee was appointed to find what suitable machines were available for this job.

After gathering information on ditching machinery from many countries, they narrowed the search to Britain and continental Europe. The committee sent two members to see equipment at work in Britain, West Germany and The Netherlands. Nine machines were chosen on the basis of initial cost and suitability for the job. They were then bought by the Experimental

Farm, Nappan, and were tested by the Nova Scotia and New Brunswick departments of agriculture. Five of the machines are for field ditches and the other four for the main channels.

MACHINES FOR FIELD DITCHES

The tests were intended to show how well the equipment could do the work, whether the farm tractor could be the power unit, how easily the equipment could be mounted, and whether it was mechanically simple. Except where noted, all the machines need a tractor with a special gearbox to reduce the forward speed to about 1,200 feet per hour when the engine is at full governed speed. This rules out conventional farm tractors for most of the machines.

The tractor selected for testing the machines was fitted with 14-inch tires, a six-to-one reduction gearbox, cage wheels, and a cab to protect the driver.

All machines were tested in conditions varying from extremely dry soil to free-flowing water. Ditches in various stages of deterioration were cleaned and new ones were dug. The five machines are described below.

Bahrs

The auger-type rotor, with mounted cutters and baffles, throws and spreads the material from the ditch. Adjustments at the front and rear adapt the machine to various ditch depths and sizes, and a handcrank control is available for use on-the-go. It works in ditches to 20 inches deep and 22 inches wide at the top. The bottom of the ditch is rounded and about 12 inches wide.

Hitch: The rotor is on two bearings in a frame that fits Categories I and II, three-point hitches. The top linkage is slack in operation and has a turnbuckle adjustment. The tractor must straddle the ditch.

Comments: Normally, this machine cleans small dale ditches to 20 inches deep but, if the banks are low and the top linkage is disconnected, it can reach down to 24 inches. It is strictly a ditch cleaner.

The machine works best in moist soil; it does not spread the spoil so well if there is free water or if the ditch is dry. When dry, much of the lighter spoil is dropped in a band, three to four feet wide, which builds up the ditch bank and blocks the flow of water to the ditch.

Not much power is needed. Any two- or three-plow tractor is ample under most conditions, if the forward speed can be reduced to one mile an hour or less.

Melio

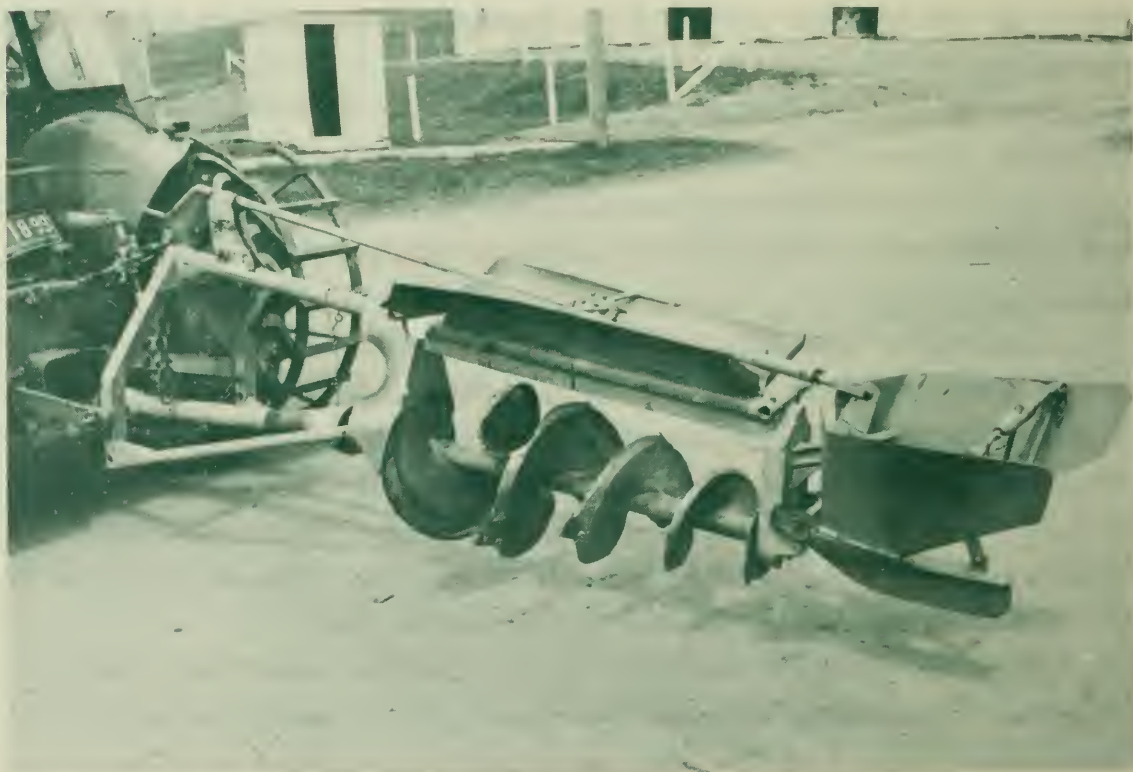
This mechanically simple and trouble-free machine has an auger-type rotor, with cutters attached, which digs and spreads the spoil over a wide area. The cutters are easily replaced or repaired. The ditch is shaped by the auger. The bottom is about 12 inches wide, but the top width varies with the depth: about 26 inches in a ditch 24 inches deep.

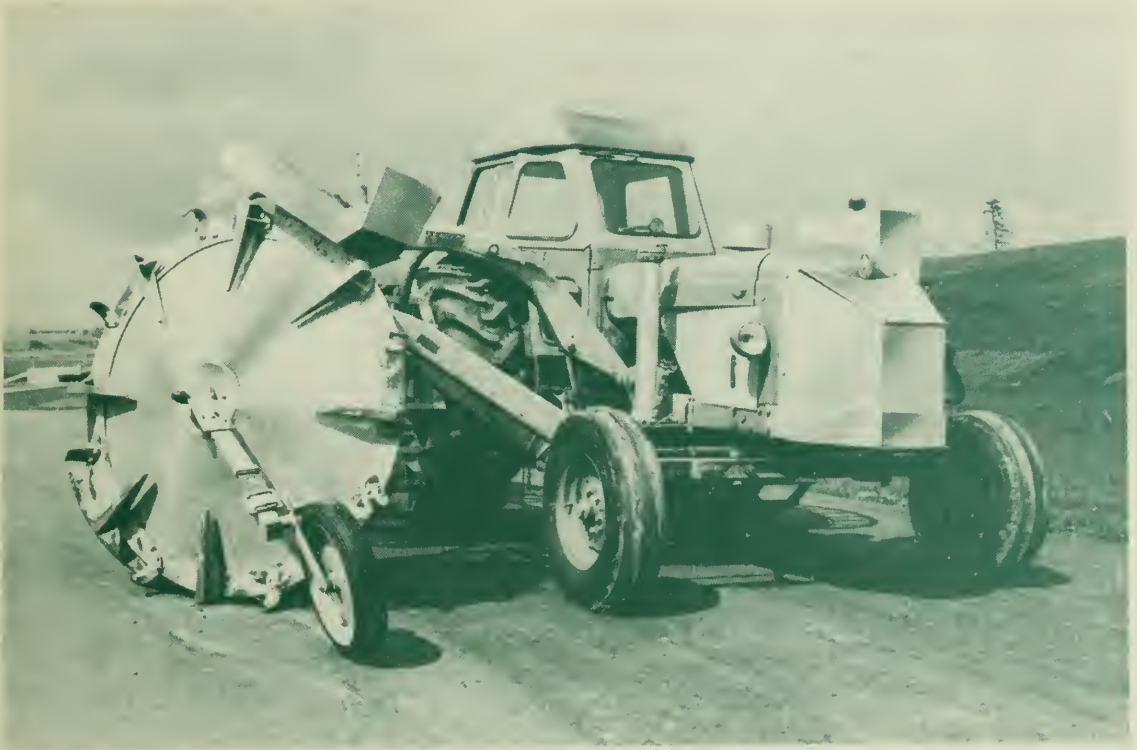
Hitch: The rotor is on two bearings in a frame that mounts on a Category II, three-point hitch. The top linkage - a chain with turnbuckle adjustment - is slack when the machine is working. Hitch and tail assembly adjust to the depth of the ditch. The tractor must straddle the ditch.

Power: The power take-off has a safety clutch.

Comments: This machine is excellent for cleaning ditches down to 20 inches. If ditches are badly deteriorated, it will clean down to about 15 inches in one pass, and another two to four inches in each succeeding pass. It is most efficient in soft, wet ground, where it can clean up to 1,000 feet per hour. Free water is no problem, except for spray drift when the wind is blowing against the throw.

The Melio field ditch machine with auger-type cutter on a three-point hitch, which is raised for transport.





The Newage ditch digger and cleaner, which is side-mounted. The hydraulic cutting wheel turns counterclockwise.

In dry soil, the work is slower, more power is needed, the cutters wear faster and spoil disposal is not so good. The machine can remove a heavy growth, but overgrown banks may hamper the disposal.

This machine is primarily a cleaner but it cuts a new ditch satisfactorily if the ground is soft and wet. Several passes must be made for depths below 15 inches.

This machine works successfully on a standard farm tractor with a ground speed of one mile per hour or less.

Newage

Built for side-mounting on a Fordson Power Major tractor, this machine consists of a hydraulic rotor with eight cutting blades to shape the ditch and eight beaters to eject and scatter the spoil. These are fitted alternately on the rim of the rotor. The rotor turns clockwise, viewed from the rear, at about 120 r.p.m. The depth of cut, down to 4½ feet, is adjusted by a gauge wheel that runs in the ditch ahead of the cutting rotor. The tractor travels on the left side of the ditch and the spoil is spread ahead

of it at an angle to the line of travel.

Hitch: The rotor is mounted on a hydraulically lifted linkage at 36 degrees to the center line of the ditch.

Power: Hydraulic power comes from a pump mounted on the front of the tractor and driven from the end of the crankshaft.

Comments: This machine cleans old ditches if the growth is not very heavy and the shape is about the same as the cross section of the rotor. The most suitable shape is 30 to 36 inches deep with steep sides and a top width of 30 inches. Six inches of spoil can be removed in one pass under most conditions. The spoil is spread across 16 to 20 feet with no marked buildup on the bank. If there is free water, the slightest headwind carries the spoil back onto the windshield and reduces the visibility. This specialized machine demands considerable skill. It was designed for ditches that are not commonly found in the Maritime marshlands.

Ridder

This machine has a wheel with three cutters on each side to form the slopes of the ditch, and the width of the wheel cuts the flat bottom. The

The Ridder field ditch machine mounted on a tractor with cage wheels. The cutting wheel revolves counterclockwise.





The Ritscher field ditch machine, showing its auger-type cutting device, hood and outlets.

tailpiece, or follower, smooths the ditch.

Wheel: The machine can be bought with any of several wheel shapes to vary the cross section and depth. The model bought for trial forms a 10-inch bottom and side slopes of 1:1.

Hitch: The frame is designed for mounting on a standard Category II, three-point hitch. The top linkage is completed by a chain that is slack when the machine is operating. The tractor must straddle the ditch.

Power: The gears change the direction only; the wheel turns at power-take-off speed.

Comments: The machine cleans surface drains to 20 inches deep, and can reach 28 inches if the original top width is 30 inches or more. It removes material from badly clogged ditches to a depth of 15 or 16 inches in one cut at a forward speed of 1,200 to 1,800 feet per hour, depending on moisture and vegetation. The spoil is thrown and scattered in one direction.

Although the machine works well under a wide range of conditions, it does best when the soil is saturated. The drier the soil, the more power it needs. It performs well in peat and mineral soils. This is essentially a cleaner but it may also be used to dig ditches.

Ritscher

The vertical auger of this machine cuts and elevates the spoil into a drum within the hood, and beaters discharge it through outlets in the sides. The discharge is evenly distributed over about 30 feet on both sides.

Auger: The cone-shaped auger makes a ditch roughly V-shaped, with a top width of 24 inches when the depth is 24 inches. Notches located at four-inch intervals on the edge of the auger serve as cutters. The cutters are replaced by renewing the lower six inches of the auger.

Hitch: The machine mounts on a Category II, three-point hitch. The tractor must straddle the ditch.

Power: The auger turns at power-take-off speed and also operates in reverse, which is useful when the machine becomes clogged.

Comments: The machine operates best in ditches 18 to 20 inches deep but is satisfactory down to 30 inches if the top of the ditch is wide enough for the hood. The sides of the ditch are left smooth and uniform, and practically no loose material falls back. It works best in wet conditions; free water is an advantage in sticky soil. In dry soil it needs a lot of power. The disposal of spoil is ideal except when the soil is sticky. This machine is essentially a cleaner but it can dig ditches in very soft soil.

MACHINES FOR MAIN CHANNELS

For cleaning the main channels, dug originally with draglines, the committee considered how well the four machines chosen could do the work and whether they were adaptable to various shapes and sizes of ditches. The following comments describe each machine and its performance.

Gold Digger

This machine has an impeller and two parallel, horizontal gathering augers to remove the material. A winch at the front hauls the machine along with a cable and anchor. Two handles at the rear are used to guide it.

Power: The engine is mounted within and above the casing, which is built to conform to the shape of the ditch bottom. This motor powers the impeller and augers, and also drives the winch.

Comments: This machine will remove four to 10 inches of silt from the ditch bottom and spread it over a wide area. It is not suitable for removing heavy plant growth. It is a specialized maintenance machine for ditches not less than 30 inches wide at the bottom and one to four feet



The Gold Digger main ditch cleaner in action, showing the winch cable and disposal of the spoil.

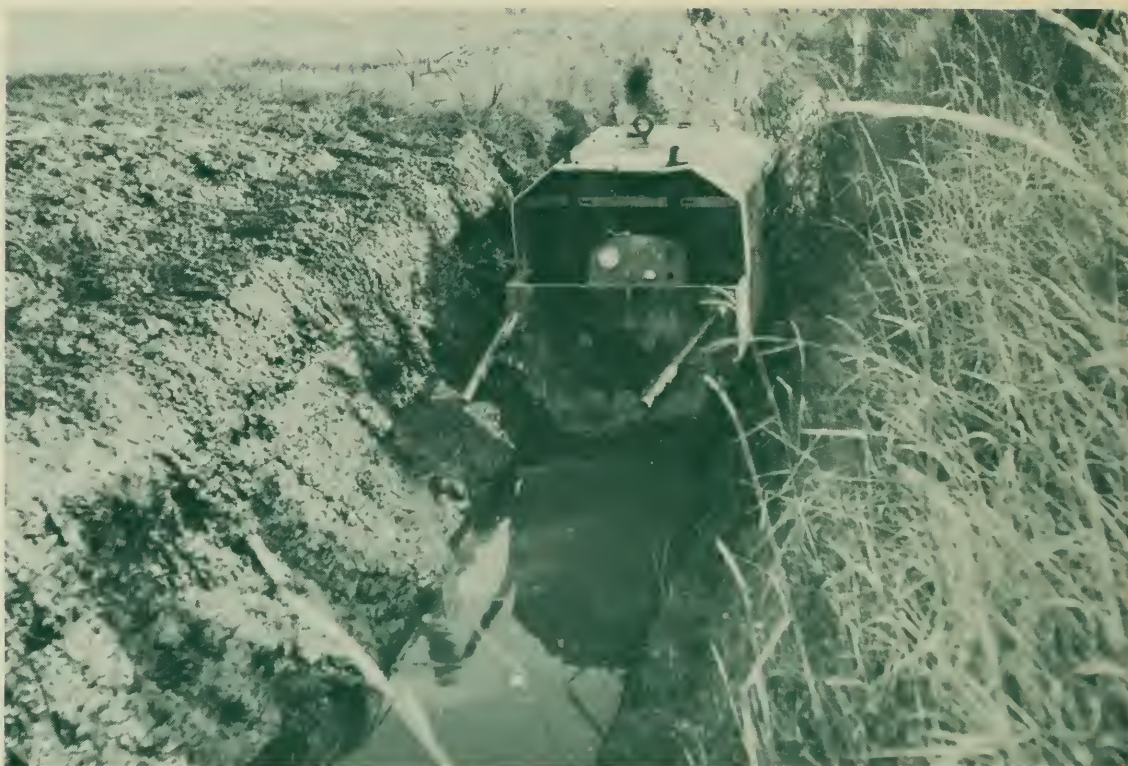
deep. Free water is needed for efficient work.

Grabenfrei

A waterproof casing shaped to conform with a typical ditch section forms the body of this machine. The front-mounted impeller is 20 inches across and turns at about 1,000 r.p.m., throwing earth from the ditch. No more spreading is needed. The operator balances and steers the machine with two handles at the rear. A trailer is supplied for transport between jobs.

Power: The engine is mounted in a waterproof casing and drives the impeller through a gearbox and V-belts. A winch on the trailer, powered by the P.T.O. from a farm tractor, hauls the ditcher along while the impeller does the cleaning.

Comments: The machine removes about six inches of material from the ditch bottom and spreads it as far as 50 feet away. It works best in ditches with straight sides, about two feet wide and two to four feet deep, with about 10 inches of water. In these conditions it removes plant growth



A rear view of the Grabenfrei. This machine works best in steep-sided ditches.

The McConnel ditch cleaning attachment mounted on a three-point hitch.



and silt efficiently, leaving a clean, free-flowing ditch. The operator requires some training and skill to operate this machine efficiently. It is a cleaning machine only.

McConnel

This attachment for a power arm is a lightweight backhoe working at a right angle to the tractor, which travels parallel to the ditch. The cleaner that was tested does not rotate but dumps the material on the bank behind the tractor. Its farthest reach is 11½ feet from the center line of the tractor, and it can reach a maximum depth of seven feet.

Hitch: The equipment mounts on a standard Category II, three-point hitch. After the first installation, it can be attached or removed in 10 minutes.

Comments: The attachment will operate on an ordinary farm tractor. It is primarily a ditch cleaner but will also dig ditches. It removes a semicircular section about three feet wide from the bottom of the ditch. The spoil is left close to the ditch bank and in most cases a second trip is needed to move it out where a bulldozer can spread it. A later, improved model of this machine will swing through 180°, permitting spoil to be dumped farther from the ditch.

York

This machine is essentially a small dredge on pontoons, with an auger-type gear acting as cutter and suction pump. The auger can be moved horizontally and vertically. It is inside a tube that has half the lower end cut away for a length of three feet. The exposed section cuts the material and mixes it with water to make a slurry. The mixture is then carried by the auger to an impeller, which discharges it in a uniform layer up to 50 feet from the bank.

The equipment is made for ditches that are six feet wide or more at water level, and it cleans to a depth of 3½ feet below the pontoons. With the pontoons fully extended, it can clean a ditch 10 feet wide in one pass, and up to 15 feet wide in two passes. By swinging and lifting the auger, the sides can be made vertical, sloped or curved.

Power: The machine is driven by a motor mounted on the pontoons. A hydraulic winch, mounted in front, pulls it along by means of a cable anchored ahead.

Comments: This machine cleans and digs channels, removing 50



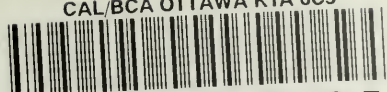
A view of the York from behind shows how it discharges the spoil.

cubic yards of spoil per hour from badly clogged and silted ditches under favorable conditions. The spoil is discharged up to 50 feet in one direction. No more spreading is necessary. It is preferable to have the discharge carried with the wind away from the machine.

A heavy growth of green cattails caused some clogging of the auger and impeller, but this was corrected by reducing the clearance between the auger and the casing. Mowing and removing top growth beforehand will speed up the work.

There should be about 16 inches of free water in the ditch to produce the slurry for the auger and impeller, but the machine can work with less if the water flows rapidly to the working face.

Some trade names are used in this publication because it is impractical to identify the machines in any other way.



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