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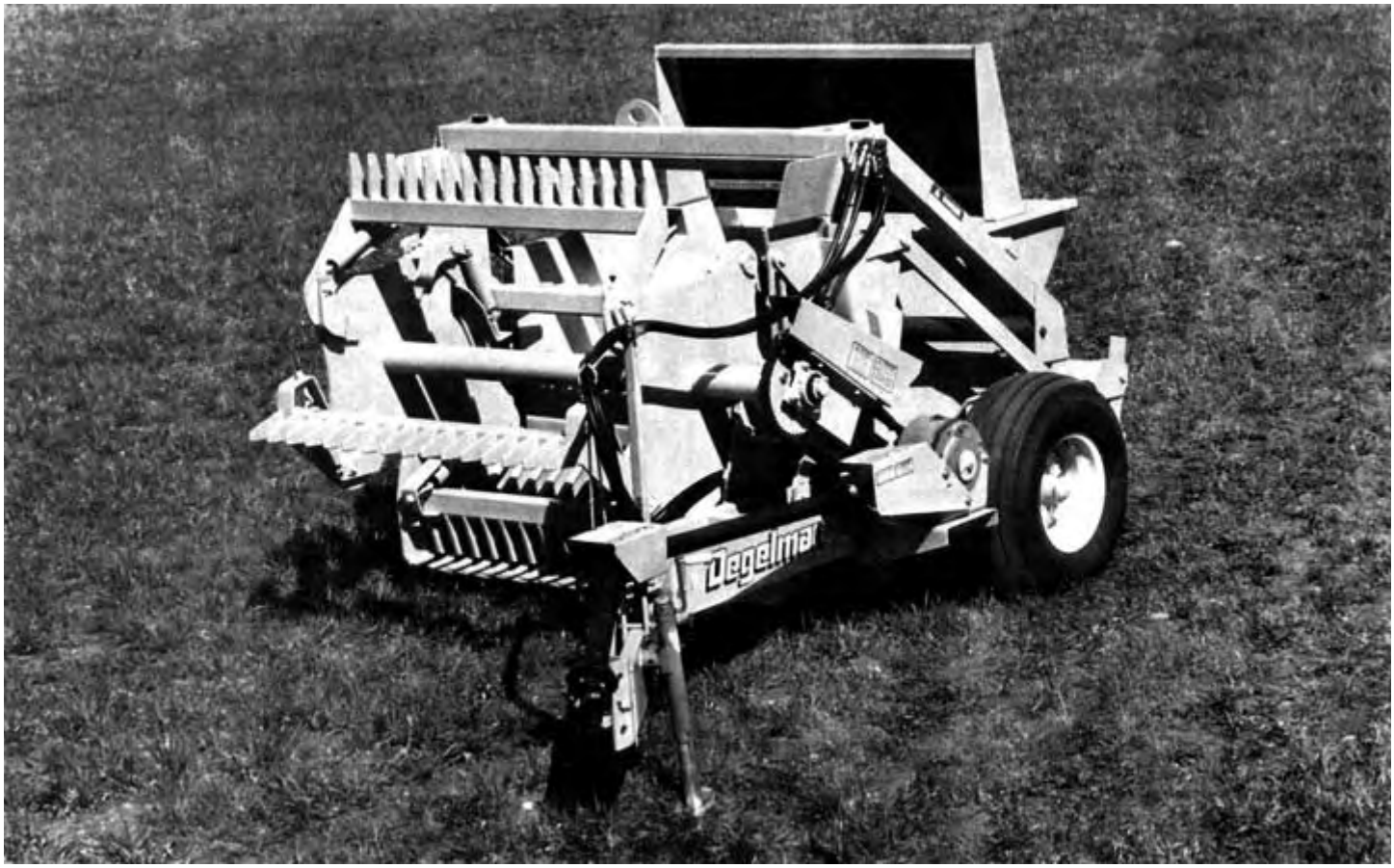


Degelman High Lift Rock Picker

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

DEGELMAN HIGH LIFT ROCK PICKER

MANUFACTURER AND DISTRIBUTOR:

Degelman Industries Ltd.
Box 830
Regina, Saskatchewan
S4P 3B1

RETAIL PRICE:

$9,870.00 (December, 1981, f.o.b. Humboldt, complete with optional power take-off drive, rock guard and four bat reel).

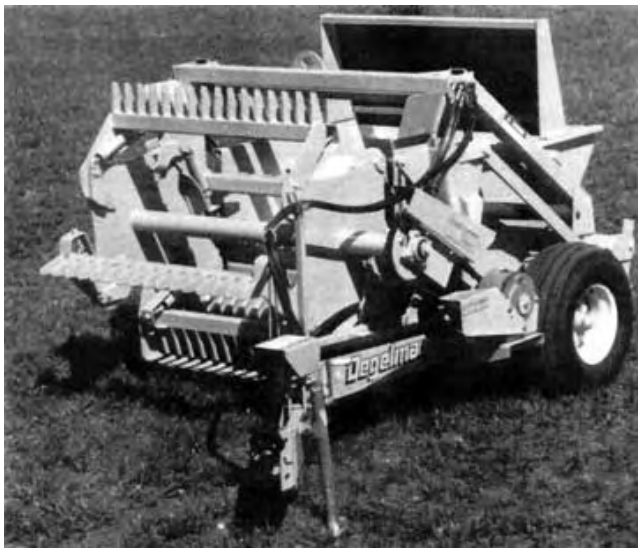


FIGURE 1. Degelman High Lift Rock Picker.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Degelman High Lift rock picker was good in both small and large rocks. Ease of operation and adjustment were good.

Typical field speeds were from 2.5 to 4 km/h (1.5 to 2.5 mph) in scattered rocks and from 1.0 to 3.1 km/h (0.6 to 1.9 mph) in windrowed rocks. Ground speed was usually limited by rock build-up on the grate. The Degelman High Lift could pick rocks from 45 to 685 mm (1.8 to 27 in) in size. In rocks greater than 330 mm (13 in) in size, the workrate was reduced by rocks frequently jamming between the reel and the grate.

The amount of soil and trash delivered to the hopper depended on operating depth, reel speed and field conditions. In most conditions, soil retention was small.

Hopper capacity was about 1814 kg (4000 lb). The hopper dumping height of 2310 mm (91 in) was adequate for piling rocks.

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Degelman High Lift in most field conditions. The Degelman rock picker transported well at speeds up to 40 km/h (25 mph).

The operator manual contained a parts list, detailed assembly instructions, a list of safety precautions and information on adjustments and operating procedures.

The Degelman High Lift was safe to operate as long as normal safety practices were observed. A serious safety hazard was encountered when removing rocks that had jammed between the reel bat and the grate. A slow moving vehicle sign was not supplied.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to reduce rock jamming between the reel bats and grate.
2. Providing a more convenient transport lock.
3. Supplying a slow moving vehicle sign.
4. Modifications to protect the right grate cylinder hydraulic fittings from rock damage.

Senior Engineer: G.E. Frehlich

Project Technologist: D.H. Kelly

THE MANUFACTURER STATES THAT

With regard to recommendation numbers:

1. We feel this problem is primarily due to the lack of operating experience. In very heavy rock conditions, coordination of reel speed and forward speed becomes of greater importance to provide the momentum for smoother action in the movement of rocks into the hopper. This coordination improves considerably with operator experience. In combination with this, experience will also dictate the windrow density so that under extremely heavy conditions a narrower windrow width is used to prevent overloading the reel bats.
2. We have not experienced a service problem with the transport lock and our present stock does not indicate any faults. However, we will check this to ensure no problems develop. Our manual has been revised to illustrate the current transport lock.
3. A slow moving vehicle sign will be installed on future production.
4. This matter is under consideration for modification.

NOTE: This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX III.

GENERAL DESCRIPTION

The Degelman High Lift is a pull-type rock picker with a 1.5 m (58 in) wide grate. As standard equipment, it is supplied with a ground driven reel. The test machine was equipped with an optional power take-off driven reel.

The Degelman High Lift is designed for picking rocks from the soil surface. An inclined, adjustable finger grate, consisting of 15 steel bars spaced at 45 mm (1.8 in) operates just beneath the soil surface. Rocks are assisted onto the grate and conveyed along it, into a hopper by a circular reel. The reel has four spring loaded bats, each with 16 teeth. The hopper holds about 1814 kg (4000 lb) of rocks. Grate height and hopper dumping are hydraulically controlled.

SCOPE OF TEST

The Degelman High Lift was operated in the conditions shown in TABLE 1 for 108 hours. Most of the tests were conducted in severe windrowed rock conditions. The Degelman High Lift was evaluated for rate of work, quality of work, ease of operation and adjustment, power requirements, safety and suitability of the operator manual.

TABLE 1. Operation Conditions

Rock Size	**Hours**
Less than 200 mm (8 in)	35
200 to 300 mm (8 to 12 in)	46
Greater than 300 mm (12 in)	27
Total	106
Rock Concentration	Hours
Light	6
Medium	15
Heavy	87
Total	108

RESULTS AND DISCUSSION

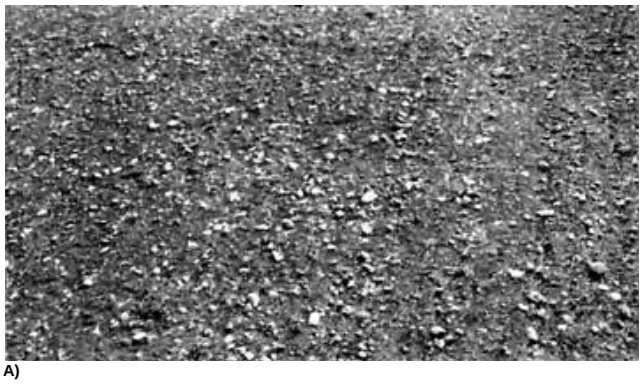
RATE OF WORK

Suitable field speeds ranged from 2.5 to 4 km/h (1.5 to 2.5 mph) in scattered rocks and from 1 to 3.1 km/h (0.6 to 1.9 mph) in windrowed rocks. Maximum speed was determined by operator skill, rock size, rock concentration, and field conditions. In heavy rock concentrations, rock build-up on the grate limited ground speed to 3 km/h (2 mph). Ground speed was further reduced in rocks larger than 330 mm (13 in) since the reel frequently jammed.

QUALITY OF WORK

Picking Characteristics: The reel bat arms were spring loaded to allow the bats to retract up to 330 mm (13 in) to clear obstructions. An adjustable slip clutch was provided on the power take-off shaft.

Reel aggressiveness was good. If too many rocks were fed onto the grate, the reel bats retracted over the rocks causing rock build-up on the grate. In heavy concentrations of small rocks (FIGURE 2), two passes were usually needed to remove most of the rocks.



A)

B)

FIGURE 2. Performance in Small Rocks: A) Before Picking, B) After Two Passes with Picker.

In large rocks (FIGURE 3), one pass was usually sufficient. Large rocks frequently jammed between fully retracted reel bats and the grate (FIGURE 4) stopping the reel. A tractor and chain were used to pull out occasional jammed rocks since the power take-off drive prevented the reel from being reversed. Modifications to reduce rock jamming are recommended.

A)

B)

FIGURE 3. Performance in Large Rocks: A) Before Picking, B) After One Pass with Picker.

FIGURE 4. Typical Rock Jam.

The 1.5 m (58 in) grate was wide enough to accept most rock windrows. In non-windrowed areas of concentrated rock, a wider grate would be desirable.

Reel Speed: Proper reel speed was necessary to fully utilize hopper capacity and to obtain maximum workrate. The 40 rpm reel speed, corresponding to a power take-off speed of 540 rpm, was adequate for most field conditions.

To effectively remove surface rocks and to minimize soil retention in the hopper, both the reel speed and the ground speed had to be selected to suit field conditions. In scattered rocks, best performance was achieved with a tooth index[1] of about 2.9 in fields with light rock concentrations, 3.6 in fields with medium rock concentrations, and 4.7 in fields with heavy rock concentrations. In windrowed rocks, best performance was achieved with a tooth index of about 3.7 in fields with light rock concentrations, 5.7 in fields with medium rock concentrations and 11.7 in fields with heavy rock concentrations. Operating at the recommended reel speed of 40 rpm, corresponding ground speeds were about 4, 3.3 and 2.5 km/h (2.5, 2.0 and 1.5 mph) in scattered rocks for light, medium and heavy rock concentrations, respectively. In windrowed rocks, ground speeds were about 3.1, 2.0 and 1.0 km/h (1.9, 1.2 and 0.6 mph) for light, medium and heavy rock concentrations, respectively.

Operating Depth: The operator manual recommended operating with the grate just touching the soil surface. This was adequate for removing rocks lying on the surface, however, partially buried rocks were pushed back into the soil by the grate. The grate could be set below the soil surface to remove small embedded rocks if the field was not too firm. Caution was needed to prevent damage to the grate and frame when working in fields containing large embedded rocks.

Trash and Soil Retention: The amount of soil and trash placed in the hopper depended on machine operation and field preparation. The amount of soil retained was small in most field conditions. Operating with the grate set too low, the reel speed too fast or in fields containing dirt lumps or trash increased the amount of soil and trash retained. Properly formed, clean windrows were necessary to minimize soil retention when picking fields windrowed with a rock rake.

Field Preparation: Best performance was in fields with a firm base and a minimum amount of trash or dirt lumps. It is often desirable to use a rod weeder before picking to place rocks on the surface, and to firm the soil.

The use of a rock rake is recommended when working in fields with an abundance of rocks smaller than 300 mm (12 in). The rock rake brings most rocks to the surface and reduces picking time.

Stability: The Degelman High Lift was very stable. Skewing occurred only when the grate hooked large subsurface rocks. When this occurred, the grate either jumped over the rock or the picker skewed to the left until the grate cleared the rock.

Rock Size: The Degelman High Lift could effectively remove rocks ranging in size from 45 mm (1.8 in) to 685 mm (27 in). Rocks smaller than 45 mm (1.8 in) fell through the grate and remained in the field. Rocks larger than 685 mm (27 in) would not pass between the reel centre shaft and the grate.

1The tooth index is the ratio of the tangential tooth tip speed to the forward speed. A high tooth index gives aggressive picking action.

EASE OF OPERATION AND ADJUSTMENT

Reel Drive: The test machine was equipped with the optional power take-off reel drive. Reel speed was 40 rpm, at 540 rpm power take-off speed, which was adequate for most field conditions. Reel speed could be lowered by decreasing tractor engine speed. The slip clutch was easy to adjust. It effectively prevented driveline damage during the test.

Bat force was adjusted by changing the tension of the reel springs. Clearance between the bat teeth and the grate was not adjustable.

The reel could not be reversed to clear rock blockages or build-up on the grate.

Hopper Dumping: The hopper held about 1815 kg (4000 lb) of large or small rocks when completely filled (FIGURE 5). One pair of tractor remote hydraulic outlets raised the hopper to the desired dumping height, while a second pair of hydraulic outlets controlled the grate height and the dumping of the hopper. To dump the hopper, the grate was lowered to the ground until the front edge of the hopper had raised about 25 mm (1 in). The hopper was then raised to the desired dumping height and the grate was lowered to dump the hopper. The hopper emptied completely and could pile rocks from 550 mm (21.6 in) to 2310 mm (91 in) high.

A)

B)

FIGURE 5. Typical Hopper Loads in A) Small Rocks, B) Large Rocks.

Maneuverability: The Degelman High Lift was quite maneuverable. Its turning radius was short enough for easy operation, however, normal care had to be taken to prevent interference between the tractor tire and the picker frame when making right turns.

Since it is desirable to feed rocks into the rock picker without driving over them, the distance between the hitch and the outside of the right tractor tire should not exceed 950 mm (37 in).

Transporting: The Degelman High Lift was easily transported. It towed well at speeds up to 40 km/h (25 mph). The 100 mm (4 in) transport clearance was adequate on roads, however, the grate frequently hooked on rocks when transporting the fully loaded rock picker in soft fields. One transport lock (FIGURE 6) prevented the grate from being lowered while transporting. The hydraulic cylinders did not lift the grate high enough to install the transport lock. The lock could be installed by raising the grate with a jack.

Modifications to provide a more convenient transport lock are recommended.

Hitching: The Degelman High Lift was easily hitched to a tractor. A hitch jack was provided and the hitch clevis was fixed allowing one-man hook-up. The hitch clevis was adjustable vertically to permit frame levelling.

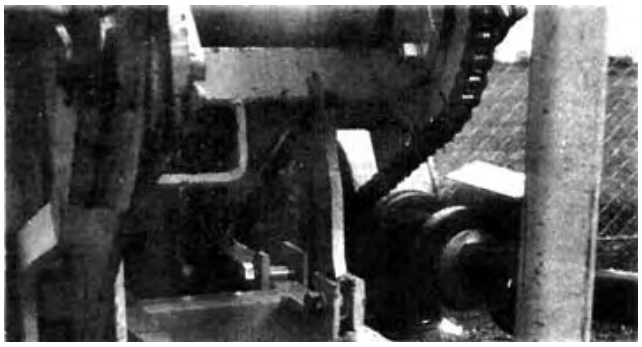


FIGURE 6. Transport Lock.

Ease of Servicing: Servicing was easy. All grease fittings and chains required weekly lubrication and were accessible.

POWER REQUIREMENTS

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Degelman High Lift in most conditions. Average power requirements varied widely, depending on field conditions. High draft forces occurred when the grate hooked partially buried rocks.

OPERATOR MANUAL

The operator manual contained a parts list, detailed assembly instructions, a list of safety precautions, and information on machine adjustments and operation. The manual contained transport lock installation information that applied to an older model.

OPERATOR SAFETY

The Degelman High Lift was safe to operate and service as long as common sense was used in following good safety procedures.

A serious safety hazard was encountered when rocks jammed between the reel bat and the grate, fully retracting the reel bat under spring pressure. Serious bodily harm could result if the bat suddenly released when the operator was removing the rock. Modifications to reduce the frequency of rock jams have been recommended.

The maximum load on each of the two 12.5 L x 15, 8-ply tires was 2399 kg (5290 lb) with a full hopper. This exceeded the maximum load of 1569 (3460 lb) recommended by the Tire and Rim Association. Although the tires were overloaded, no failures occurred during the test.

No slow moving vehicle sign was supplied. It is recommended that a slow moving vehicle sign be supplied as standard equipment.

DURABILITY RESULTS

TABLE 2 outlines the mechanical history of the Degelman High Lift during 108 hours of field operation. The intent of the test was functional evaluation. The following mechanical problems are those, which occurred during the functional testing. An extended durability test was not conducted.

TABLE 2. Mechanical History

Item	Hours
Reel:	
-The reel drive chain failed and was repaired at	24, 37.46
-The reel bearing failed and was replaced at	31, 37.63
-The reel shaft failed and was replaced at	72
-One reel bat pivot pin failed and was replaced at	78
-All the reel springs were replaced at	95
Hydraulic Fittings:	
-The right grate cylinder fitting was broken by rocks and replaced at	24. 37
-A fitting on the lines crossing to the right side of the rock picker was broken and replaced at	34
Hopper:	
-The rubber rock guard tore and was repaired at	95
Drive Line:	
-The power take-off shaft support bearing failed and was replaced at	82
Hitch:	
-The hitch clevis was worn and required replacing by	end of test

DISCUSSION OF MECHANICAL PROBLEMS

Reel: The reel drive chain and reel bearings failed when rocks jammed between the reel and the grate. Modifications to reduce rock jamming should reduce reel drive chain and bearing problems.

The reel shaft, bat pivot pin and reel springs broke from extended operation of the rock picker in severe windrowed rock conditions. Reel shaft and spring failures may not occur in less severe rock conditions.

Hydraulic Fittings: The lower hydraulic fitting on the right grate cylinder (FIGURE 7) was broken by rocks missed by the grate. It is recommended that the manufacturer consider modifications to protect the hydraulic fitting from rock damage.

FIGURE 7. Grate Cylinders.

APPENDIX I
SPECIFICATIONS

MAKE:	Degelman Rock Picker
MODEL:	High Lift
SERIAL NUMBER:	261020
WEIGHT: (hopper empty)	
-- left wheel	1094 kg
-- right wheel	750 kg
-- hitch	416 kg
TOTAL	2260 kg
TIRES:	2, 12.5L x 15, 8-ply
OVERALL DIMENSIONS:	
-- width	2870 mm
-- height	1860 mm
-- length	4040 mm
-- ground clearance	100 mm
GRATE:	
-- width	1475 mm
-- number of grate bars	15
-- space between grate bars	45 mm
-- length of grate bars	750 mm
-- grate angle while operating	52 degrees
REEL:	
-- diameter	1560 mm
-- number of bat arms	4
-- number of teeth per bat	16
-- spacing between teeth	73 mm
-- tooth length	150 mm
-- reel speed at 540 rpm PTO speed	40 rpm
HOPPER:	
-- hopper dumping height	550 mm to 2310 mm
-- hopper capacity	1814 kg
NUMBER OF HYDRAULIC CYLINDERS:	4
NUMBER OF CHAIN DRIVES:	1
NUMBER OF LUBRICATION POINTS:	12
OPTIONAL EQUIPMENT:	
-- power take-off drive	
-- rock guard	
-- four bat reel	

APPENDIX II
MACHINE RATINGS

The following rating scale is used in Machinery Institute Evaluation Reports:

a) excellent	d) fair
b) very good	e) poor
c) good	f) unsatisfactory

APPENDIX III
CONVERSION TABLE

1 hectare (ha)	= 2.5 acres (ac)
1 kilometer/hour (km/h)	= 0.6 miles/hour (mph)
1 metre (m)	= 3.3 feet (ft)
1 millimeter (mm)	= 0.04 inches (in)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds mass (lb)

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