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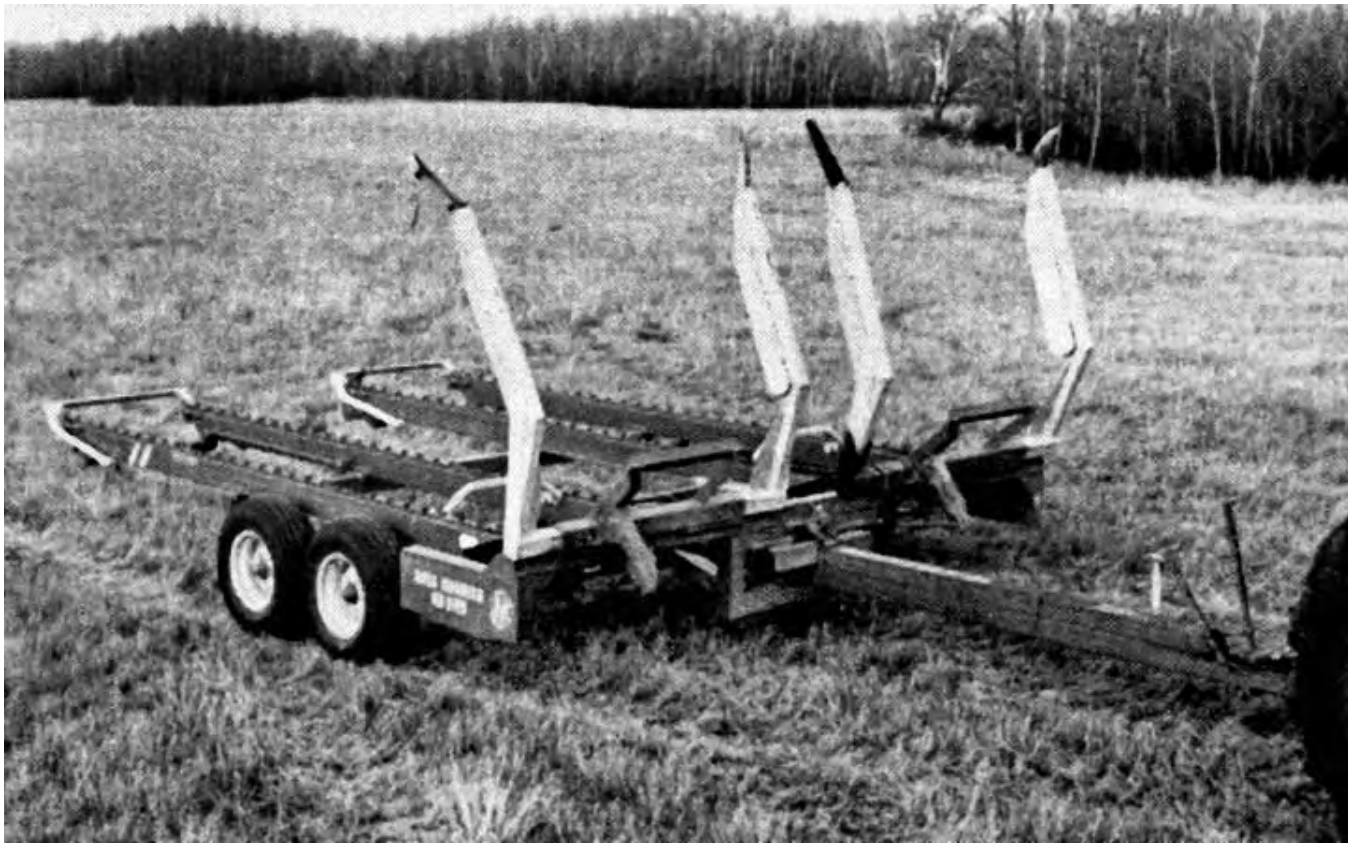

B & K Bale Karrier 815

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

B & K Bale Karrier 815

Manufacturer and Distributor:

MacDonald Bros. Metal Fabricators Ltd.
51 Aikins Street
Winnipeg, Manitoba
R2W 4E3

Retail Price:

$6300.00 (June, 1977, f.o.b. Winnipeg)

NOTE:

The mover used in this evaluation was manufactured and distributed by B & K Industries Ltd., Box 345, Killarney, Manitoba and was known as the B & K Bale Karrier 815. The mover is now manufactured and distributed by MacDonald Bros. Metal Fabricators Ltd., Winnipeg, Manitoba, and is now known as the MacDonald Bros. Model 608 Bale Karrier.

Figure 1. B & K 815 in Transport Position.

Figure 2. B & K 815 With the Tongue Positioned for Loading the Left Bed.

Summary and Conclusions

The functional performance of the B & K Bale Karrier 815 was good for loading and hauling large round bales from the field but was fair for placement of bales due to lack of control and poor visibility.

The B & K 815 handled firm bales effectively. The total capacity of the twin bed wagon was eight large round bales with three bales on each bed and one bale held in each pickup fork. If average bale weight exceeded 680 kg (1500 lb) the manufacturer's maximum load rating for the wagon could be exceeded. Operator experience was needed before bales could be loaded or unloaded in a continuous, uniform and orderly manner.

The B & K 815 towed very well when fully loaded at speeds up to 29 km/h (18 mph). The width and height of the load restricted rear visibility in transport and unloading while the double bed width limited operation on narrow roadways and in confined areas.

Overall durability was fair due to the repeated failures of fork cylinder shafts, the bed drive chain and bed chains. An experienced operator could reduce these problems by exercising caution in machine operation.

In average field conditions it took an experienced operator nine minutes to load eight bales, while unloading and placing eight bales in the storage area took about two and one-half minutes. Field efficiency depended largely on hauling distance and the speed at which the tractor could safely travel during transport. For example, in one field of alfalfa and bromegrass it took from 22 to 33 minutes to load, transport and unload eight bales and return to the field. This included 0.4 km (0.25 mi) of field transport and 0.8 km (0.5 mi) of road transport. The spring suspension on the undercarriage permitted smooth towing on rough fields.

Caution should be exercised in unloading due to poor rear visibility.

Recommendations

It is recommended that the manufacturer consider:

1. Modifications to prevent bales from falling between the two beds.
2. Modifications to eliminate pickup fork cylinder shaft failure.
3. Providing a Slow Moving Vehicle sign as standard equipment.
4. Modifying the pickup fork flipper wedges to make flipper action more positive.
5. Modifying the pickup arm tips to eliminate tip failure.
6. Providing a tailgate position indicator.
7. Modifications to prevent the load from sliding rearward, due to free rotation of the rail chains, when loading up steep slopes.
8. Modifications to eliminate wheel toe-out with a loaded wagon.

Chief Engineer: E. O. Nyborg
Senior Engineer: L. G. Smith
Project Engineer: T. G. Strilchuk

The Manufacturer States That:

With regard to recommendation number:

1. A bar has been installed as standard equipment to prevent bales from falling between the two beds.
2. The diameter of the pickup fork cylinder shaft has been increased.
3. A bracket for a Slow Moving Vehicle sign has been provided as standard equipment.
4. This recommendation is under investigation.
5. The pickup arm tips have been redesigned and strengthened to eliminate tip failure.
6. A tailgate position indicator is available as an option in 1977.
7. This recommendation is under investigation.
8. The load points have been redesigned and repositioned to give proper load distribution and prevent wheel toe-out.

Additional comments are as follows:

The bed length on the Model 608 Bale Karrier has been increased to accommodate larger diameter bales.

General Description

The B & K Bale Karrier 815 (Figures 1 & 2) is a self loading, non-tilting, twin bed, four wheel trailer with two axles, for use with tractors 46 kW (60 hp), or larger, equipped with dual hydraulics. Bales are picked up either on the left or right side of the tractor with hydraulic forks, which place bales crossways on either bed.

The main frame has two pickup forks on either side of a swinging tongue. The twin beds each consist of two chain rails spaced at 840 mm (33 in). Each 4710 mm (15.5 ft) long bed holds three bales, with a fourth held by the fork in the half-raised position.

Raising a bale fork pulls a spring tensioned roller chain over a system of sprockets to drive a sprag clutch on the head shaft of the transfer chains. This moves the load on the bed to the rear allowing the oncoming bale to be placed on the bed.

For unloading, the tailgates at the rear are hydraulically lowered and a bale is dropped off the end of the bed with each cycle of the pickup fork. Complete specifications are found in Appendix I.

Scope of Test

The B & K 815 was operated in typical prairie fields (Table 1) for 96 hours while moving about 800 large round bales.

It was evaluated for ease of operation, quality of work, operator safety and suitability of the operator's manual.

Table 1. Operating Conditions

Crop	Hours	Field Topography	Field Conditions
Native Grassland	34	Gently rolling	Rough, Occasional stones
Wheat Straw	17	Gently undulating	Slightly ridged
Sweet Clover	20	Moderately rolling	Smooth
Alfalfa, Bromegrass and Crested Wheatgrass	25	Gently Rolling	Rough, Occasional stones

Results and Discussion

EASE OF OPERATION

Hitching: The B & K 815 was equipped with an adjustable clevis hitch. A properly sized hitch pin with a suitable locking device made the hook-up reliable and safe. Four hydraulic hoses and two actuating ropes for the tongue lock and selector valve also had to be attached to the tractor.

Loading: The B & K 815 is placed in field loading position by swinging the tongue either to the fight or to the left depending on which bed is to be loaded first. With both forks in the raised position the tongue latch is unlocked with a rope and by making a sharp turn, the tongue slides to the appropriate side and locks in position.

With the tongue locked to one side and with the tailgates raised, the mover is ready for loading. Bales are approached from the front with the axis of the bale perpendicular to the direction of travel. The pickup fork is lowered until the arms are parallel to the ground. Being certain that the bale centres in the fork, the arms are raised when the bale touches the fork back brace. The plate flippers on each tine rotate to grip the bale as the fork is raised. A spring-loaded bale stop prevents the bale from rolling onto the bed after it frees itself from the flippers by its own weight. Successive bales are loaded in the same way with the load on the bed automatically moving rearward with each cycle of the pickup fork.

The fork should not be returned to picking position until a bale is being approached. If the fork is lowered and unintentionally raised before picking the second bale, the bale already on the bed moves rearward creating gaps between successive bales. Gaps could also result when picking bales up steep hills. When travelling up steep hills with a partially loaded bed, the load sometimes slips rearward as there is no lock to prevent rotation of the bed chains.

If gaps are created between bales, they are eliminated when the first bale contacts the end gate causing it to slip on the transfer chains as the other bales crowd against it. This causes unnecessary load on the bed transfer chains and chain drive.

Operator experience was required before bales could be loaded non-stop. True approach of the bale fork on the bale was very important although some misalignment was acceptable. Bales, which were not exactly centred between the tines, skewed sideways and were placed at an angle on the bedrails. Skewed bales occasionally toppled between the beds as more bales were loaded, (Figure 3). Tapered bales also sometimes fell between the beds as they moved rearward on the transfer chains, necessitating a tractor and front end loader to remove them. A centre guardrail, installed between the two beds, would eliminate this problem.

Figure 3. Skewed Bale Wedged Between the Two Beds.

A similar problem occurred if the flipper on one of the fork tines failed to grip the bale at the beginning of the left cycle. The bale then tipped in the pickup arms and was placed on the bed in a skewed position. More positive spring loaded flippers would remedy this problem. Timing the forklift was not critical, as skidding the bale on the ground did not damage the twine since the bale was picked crossways.

Slight misalignment during approach could be corrected if forward speed was maintained, causing the bale to straighten itself as it contacted the back brace of the pickup fork.

The fourth bale is held against the load on the pickup fork in half raised position. This allows the tongue to be repositioned to the loaded side enabling the opposite bed to be loaded in the same manner (Figure 4).

Figure 4. B & K 815 With the Left Bed Fully Loaded.

Insignificant bale damage occurred when loading firm well wrapped bales. Some hay loss occurred from ragged edges on loose bales. Untied bales unfurled resulting in significant losses.

The B & K 815 had a 4712 mm (15.5 ft) bed length. There was no difficulty in loading eight round bales regardless of size variations. The manufacturer's maximum load rating for the wagon was 5450 kg (12,000 lb). This meant that if average bale weight was more than 680 kg (1500 lb) the wagonload rating could be exceeded with eight bales.

Transporting: When fully loaded the tongue is moved to centre position between the two beds allowing the mover to tow directly behind the tractor (Figure 5). For travel on public roadways a Slow Moving Vehicle sign had to be attached to the rear as none was supplied with the B & K 815. A suitable location for an SMV sign is on the tailgate (Figure 6).

Figure 5. B & K 815 Fully Loaded in Transport Position.

Figure 6. SMV Sign Mounted on Rear Tailgate.

The B & K 815 towed well on rough fields and trailed well on roadways at speeds up to 29 km/h (18 mph). The dual axle spring

suspension gave a smooth ride on rough terrain. With a full load the axles bowed slightly causing the wheels to toe out.

The load height and width completely restricted vision behind the mover. The double width of the mover meant that the operator had to be careful when passing through narrow gates or travelling on narrow roadways.

Losses during transport were insignificant for firm bales and were slight for ragged or loose bales.

Placement: Before unloading, the tailgates are lowered by switching the selector valve with the pull rope and engaging the appropriate tractor hydraulic control. Both gates operate together with the same hydraulic cylinder. Since the operator cannot see the tailgates on the loaded mover, the only indication that the tailgates are down is from the sound of the bypass valve in the tractor hydraulic system. The pickup forks are then raised, either individually or together, placing the fourth bale completely on the bed. This advances the rail chains causing the rear bales to roll onto the ground. If the pickup forks are raised before the tailgates are dropped, the fork cylinders apply their full force against the load. The rail chains are protected with a shear pin, however, attempting to lift the fork bends the shaft on the fork lift hydraulic cylinder (Figure 7) before the tractor hydraulic system relieves. Three fork cylinder shafts bent during the test. Modifications to prevent lift fork cylinder shaft failures are required. A tailgate position indicator would also be useful.

In starting a row, the first bale dropped off the bed is free to roll so it should be dropped on fiat ground or against some restraint such as a fence. Successive bales are unloaded by moving forward the distance required for one bale and operating the pickup forks through a complete cycle. Sometimes a bale would not roll off the bed with one pickup fork lift cycle. The forks then had to be lowered part way and raised to move the rail chains enough to drop the bale. Since the operator could not see the back of the mover it was difficult to judge when a bale had dropped off the bed and when to move forward. It was easier to judge when a bale had dropped if each bed was unloaded separately. The reaction of the mover, as a bale dropped, was easier to detect if only one pickup fork was operated.

Figure 7. Pickup Fork Cylinder Shaft Failure.

The B & K 815 could only be unloaded from the rear. This placed bales in two rows (Figure 8) about 300 mm (1 ft) apart and with the circumferences of the bales touching in each row (Figure 9). It was difficult to maintain uniform bale spacing due to lack of control and poor visibility.

QUALITY OF WORK

The B & K 815 was effective in loading large round bales and transporting them. High work rates were possible due to the large wagon capacity. The B & K 815 was fair for placing bales in the storage yard. Poor visibility and lack of operator control reduced unloading efficiency. Both the quality of work and the rate of work were very dependent on operator experience.

Figure 8. Two Pairs of Rows Placed With the B & K 815.

Figure 9. Circumferences of Bales Touching in a Row.

Bale and twine damage was insignificant for firm bales. Hay loss occurred only when handling loose or unwrapped bales. Losses of hay during transport were insignificant.

The B & K 815 rotated bales during loading placing them on the bed in a different orientation from which they sat on the ground. During unloading, bales rolled to an arbitrary position usually with the previously weathered side down and with the flat spot, which had rested on the ground, upward. In this position, bales would probably have less ability to shed rain and would have increased spoilage due to weathering on the previously unweathered side. It is recommended that bales be moved to storage soon after baling to eliminate the possibility of weathering on two sides.

Table 2 gives an indication of expected workrate with an experienced operator. This table gives the average time, based on five trips, to load, transport, and place a load of eight large round brome-alfalfa bales from a rough field yielding 2.2 t/ha (1 ton/ac). Each one-way trip involved 0.4 km (0.25 mi) of travel from the field to a grid road and 0.8 km (0.5 mi) of road travel. As can be seen, even for a short haul, most time is spent in transport rather than in loading or unloading.

Table 2. Average Rate of Work

Travel to Field (1.2 km)	8.3 Min
Load Eight Bales	9.2 Min
Travel to Storage Yard (1.2 km)	8.7 Min
Unload Bales	2.5 Min
Round Trip	28.7 Min

OPERATOR SAFETY

The B & K 815 was safe to operate if the manufacturer's safety precautions were observed. Bystanders should not stand near the forks or on the mover during operation. Unloading should be on flat ground or against a retaining fence. The unloading area should be checked before dumping bales, as rear visibility is poor. Maintenance should not be performed on a full or partially loaded machine as large bales can cause severe injury.

The towing tractor should be sufficiently heavy and equipped with good brakes for road transport with a full load. The manufacturer recommends a minimum 46 kW (60 hp) tractor for safe road transport.

The B & K 815 was not equipped with a Slow Moving Vehicle sign or bracket. A permanently affixed sign is required as normal operation involves transport on public roads.

Individual tire loads, calculated for a fully loaded wagon, with eight 680 kg (1500 lb) bales, exceeded the Tire and Rim Association Standard maximum rating for the 11L x 15, 8-ply tires by 29%. This could be hazardous when operating at high road speeds.

OPERATOR'S MANUAL

The operator's manual clearly outlined assembly, setup and adjustments. It did not present a lubrication and maintenance schedule. Operating instructions were sketchy and problems encountered during normal operation were not discussed.

Durability Results

Table 3 outlines the mechanical history of the B & K Bale Karrier 815 during 96 hours of operation while moving about 800 large round bales. The intent of the test was evaluation of functional performance. The following failures represent only those, which occurred during functional testing. An extended durability evaluation was not conducted.

Table 3. Mechanical History

Item	Hours	Number of Bales
-A fork cylinder shaft bent, while attempting to unload, and was replaced at	5, 43, 62	56, 324, 480
-A conveyor chain link broke at	33, 89	242, 768
-The bed conveyor drive chain pickup fork connecting link broke at	39, 75	296, 584
-The tip broke off on pickup fork tine at	28	194

Discussion of Mechanical Problems

Pickup Fork Cylinder: The cylinder shaft bent and was replaced three times. In two cases the operator assumed that the tailgate was down and attempted to unload a bed. The resistance of the load caused the fork cylinder shaft to bend. In the third case the shaft bent either while in loading the fourth bale or during transport from the field. Modifications to eliminate the possibility of lift cylinder shaft bending should be considered.

Conveyor Chain: The bed conveyor chain broke during unloading. The shear bolt at the drive connecting bar did not protect the conveyor chain.

Connecting Link: The drive chain connecting link to the pickup fork also broke during unloading. Once again, the shear bolt at the drive connecting bar did not protect the drive chain.

Pickup Arm Tip: The pickup fork tine tip broke off when the fork accidentally dug into the ground while loading on a hilly field.

Figure 10. Broken Tip on Pickup Fork Tine.

APPENDIX I
SPECIFICATIONS

Model:		B & K Bale Karrier 815
Serial Number:		076 815 0112
Pickup Side:		Right and Left
Dimensions:		
-- Length		8380 mm (330 in)
-- Width	(road)	4320 mm (170 in)
	(field)	4320 mm (170 in)
-- Bed	Height	889 mm (35 in)
	Length	4712 mm (185.5 in)
-- Bed Rail Width		838 mm (33 in)
-- Ground Clearance		330 mm (13 in)
-- Tires		4, 11L x 15, 8-ply
Hydraulics:		
-- Fork Cylinder		
-Bore		89 mm (3.5 in)
-Stroke		406 mm (16 in)
-Retracted Length		667 mm (26.25 in)
-Port Size		2, 1/2 NPTF
-- Tail Gate Cylinder		
-Bore		51 mm (2.0 in)
-Stroke		203 mm (8 in)
-Retracted Length		514 mm (20.25 in)
-Port Size		2, 1/2 NPTF Weight: (unloaded)
-- Left Wheels		698 kg (1540 lb)
-- Right Wheels		728 kg (1605 lb)
-- Hitch		188 kg (415 lb)
TOTAL		1614 kg (3560 lb)
Load Capacity:		5440 kg (12,000 lb)
Tractor Requirements:		
-- Manufacturer Recommended Minimum Size		46 kW (60 hp)
-- Hydraulics		Dual

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

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

APPENDIX III
METRIC UNITS

In keeping with the Canadian metric conversion program, this report has been prepared in SI Units. For comparative purposes, the following conversions may be used:

1 hectare (ha)	= 2.47 acres (ac)
1 kilometre/hour (km/h)	= 0.62 miles/hour (mph)
1 tonne (t)	= 2 204.6 pounds (lb)
1 tonne/hectare (t/ha)	= 0.45 ton/acre (ton/ac)
1 metre (m) = 1000 millimetres (mm)	= 39.37 inches (in)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds (lb)
1 kilopascal (kPa)	= 0.15 pounds/square inch (psi)

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:

P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080