

Evaluation Report

674



Kingsman RBM-217 Round Bale Mover

A Co-operative Program Between



KINGSMAN RBM-217 ROUND BALE MOVER

MANUFACTURER AND DISTRIBUTOR:

Kingsman Industries
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RETAIL PRICE:

\$15,800.00 (f.o.b. Portage la Prairie, MB, October 1991) Quarter turn arms are optional at \$2,800.00 each.

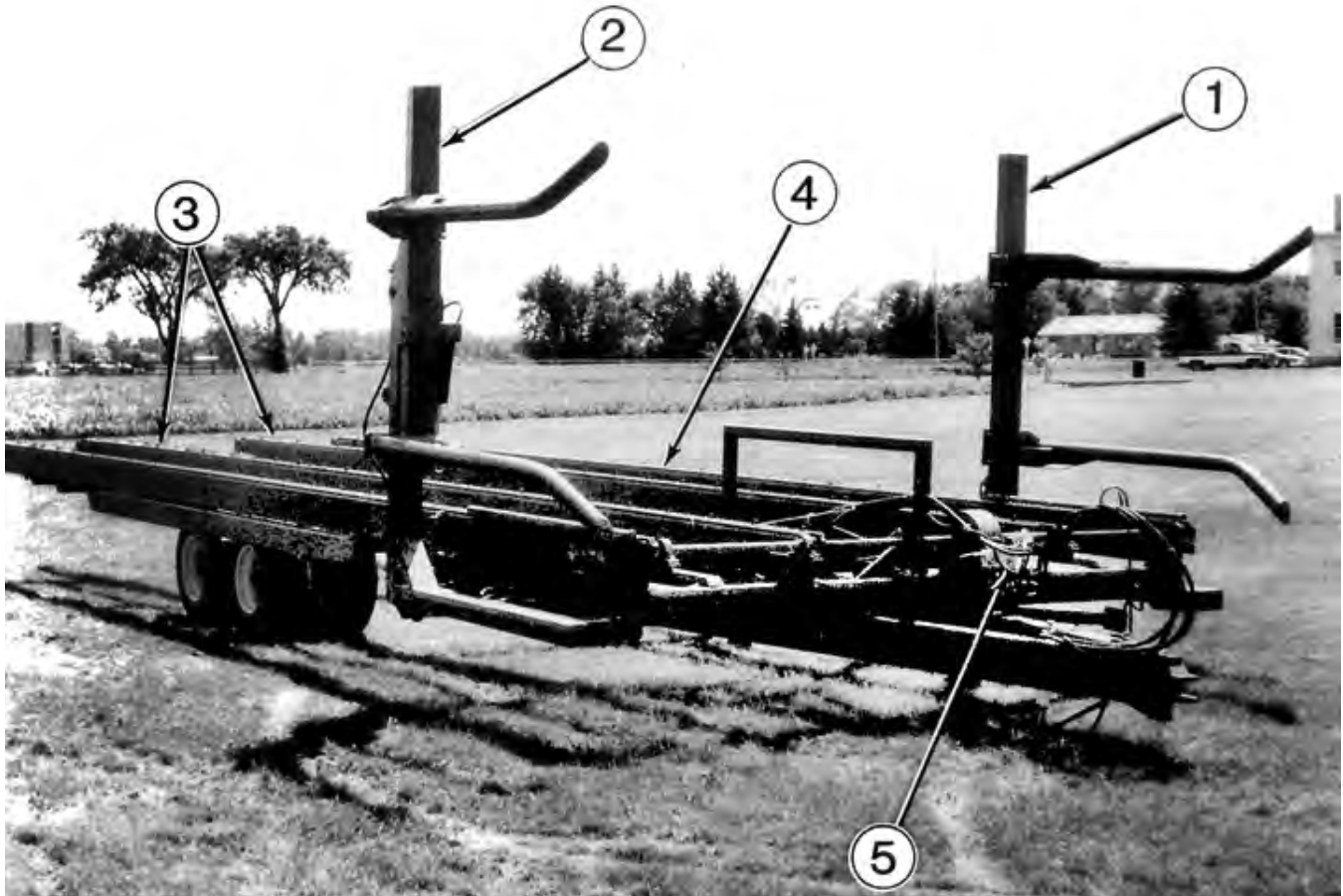


FIGURE 1. Kingsman RBM-217 Round Bale Mover: (1) Standard Lift Arm, (2) Quarter-Turn Lift Arm, (3) Bale Beds, (4) Conveyor Chains, (5) Hydraulic Motors.

SUMMARY

Rate of Work: The Kingsman 217 could be loaded with twelve bales 6 ft (1.8 m) in length or fourteen bales 5 ft (1.5 m) in length. If the bales were situated in close proximity to each other in the field, twelve bales could be loaded in about eleven minutes. Fourteen bales could be loaded in about 13 minutes. Loading performance was limited by the time required to operate the hydraulic functions, distance the bales were apart, field roughness, operator experience and dexterity. Backing to the previous load and unloading took about five minutes.

Quality of Work: The quality of work was very good. The Kingsman 217 was gentle with the bales and did not break twine during loading. The quarter turn lift arm allowed bales to be picked from the field in the same orientation from which they come from the baler.

Ease of Operation and Adjustment: Ease of hitching was very good. It involved adjusting the hitch to the proper height and connecting four hydraulic hoses and a 12 volt power supply.

Ease of loading was very good. After a bit of practise both the standard lift arm and the quarter turn lift arm were easily operated. Ease of unloading was also very good. The operation was fast and simple. Ease of reloading was good. Bales were easily reloaded by backing under them and reversing the chains,

but usually some twines were broken.

Ease of transporting was very good. The bale mover towed easily, but care had to be exercised on public roads due to restricted visibility to the rear.

Ease of adjustment was very good. Most adjustments were easily understood and completed. Ease of lubrication was very good. Grease fittings were easy to get at and daily service took about ten minutes.

Power Requirements: The Kingsman 217 round bale mover was designed to be operated with an agricultural tractor and was effectively operated with a tractor of about 110 hp (83 kW). The Kingsman required a towing vehicle, equipped with dual remote hydraulic outlets, capable of supplying 1500 psi (10.3 MPa) and a 12 volt electrical supply.

Operator Safety: Operator safety was very good. The Kingsman 217 was safe to operate if normal safety precautions were followed.

Operator's Manual: The operator's manual was fair. The manual lacked detailed information on specifications, operation and safety.

Mechanical History: A few mechanical problems were noted during the test period. A flow control valve failed twice and a conveying chain bearing failed.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a hitch safety chain.
2. Supplying a more detailed operator's manual.
3. A modification that would prevent damage to the slow moving vehicle sign.

Station Manager: B.H. Allen

Project Manager: R.K. Harris

THE MANUFACTURER STATES THAT

With regards to the recommendations:

1. As of 1992, all Kingsman Round Bale Movers will be equipped with hitch "Safety" chains. All major pins will be made of stress proof material with corresponding bushings to enhance life expectancy.
2. The operator's manual is in the process of being updated so that old and new owner operators have a well organized and illustrated manual to refer to. Specifications, operations, adjustments and especially "safety" sections will be added.
3. The slow moving vehicle sign bracket is being redesigned and positioned in a different location to eliminate the existing problem of breakage.

MANUFACTURER'S ADDITIONAL COMMENTS:

1. Due to the failure of flow control valves, Kingsman Industries has contacted the suppliers and adjustments have been made to our satisfaction to eliminate such failures in future machines.
2. The outside fork fell to the ground as a result of fluid loss, due to failure of a flow control valve. This situation has been corrected as explained in the previous paragraph. Kingsman Industries has also modified the quarter turn arm with a lock-out, in case of hydraulic failure elsewhere.

GENERAL DESCRIPTION

The Kingsman 217 round bale mover is a self loading, tilting deck, double row, eight wheel trailer. It is designed to retrieve, transport, place and reload round bales. Suspension is arranged four wheels per side in a walking beam design. The Kingsman is intended to be used with an agricultural tractor as the towing vehicle. The towing vehicle must have dual remote hydraulic outlets capable of supplying 1500 psi (10.3 MPa) and a 12 volt electrical source.

For the purpose of the evaluation, the Kingsman was supplied with two different bale retriever systems. The standard equipment fork and lift arm was mounted to the left side of the trailer and an optional lift system called a quarter turn lift arm was mounted on the right side of the trailer.

The standard arm loaded bales by approaching the bale with its longitudinal axis parallel to the direction of travel. Forks on the lift arm straddled the bale and the bale was lifted onto the trailer bale beds hydraulically.

The quarter turn lift arm allowed bales to be retrieved from the field in the same orientation as they were ejected from the baler or with their longitudinal axis perpendicular to the direction of travel.

Bales loaded on to the bale beds are conveyed to the rear by conveyor chains driven by hydraulic motors so that more bales can be loaded. Each bale bed will hold six or seven bales depending on their length for a total load of twelve, 6 ft (1.8 m) bales or fourteen 5 ft (1.5 m) bales. Bales are unloaded by hydraulically tilting the bale beds, engaging the conveying chains, and moving the tractor ahead at the same speed as the conveyor chains are operated.

The chains carry the bales off the beds. Bales can be reloaded by tilting the bed and backing into the row of bales with the conveying chains moving in reverse.

The 217 is totally hydraulically powered. Individual hydraulic functions are controlled with electric solenoid valves and tractor mounted selector buttons.

Detailed specifications are presented in APPENDIX I. FIGURE 1 shows the location of major components.

SCOPE OF TEST

The machine evaluated by PAMI was configured as described in the General Description, FIGURE 1 and the SPECIFICATIONS section of this report. The manufacturer may have built different configurations of this machine before or after PAMI tests. Therefore, when using this report, check that the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from PAMI or the manufacturer to determine changes in performance.

The Kingsman 217 was operated in typical prairie fields for about 108 hours while moving about 3450 round bales. It was evaluated for rate of work, quality of work, ease of operation and adjustment, power requirements, operator safety, and suitability of the operator's manual. The purpose of the test was functional performance, and an extended durability test was not conducted. However, a few mechanical problems were noted throughout the evaluation. TABLE 1 outlines the operating conditions.

TABLE 1. Operating Conditions

Crop	Hours	Bales	Field Conditions
Alfalfa	70	2810	Usually smooth with rough areas
Mixed Grass	8	135	Usually smooth with rough areas
Straw (Twine)	18	300	Smooth crop land
Straw (Net Wrap Bale)	4	60	Smooth crop land
Greenfeed	8	145	Smooth crop land
TOTAL:	108	3450	

RESULTS AND DISCUSSION

RATE OF WORK

Rate of work was reduced due to the configuration of the test machine. Normally the Kingsman 217 would be used with identical loading systems on each side. For the purposes of evaluation, the 217 was supplied with one standard loading arm on the left hand side and the optional quarter turn arm on the right hand side. Extra time was consumed retrieving bales when the operator changed from one form of retrieval to the other.

Rate of work was also dependant on the roughness of the field, the hydraulic cycling time, crop proximity, experience and dexterity of the operator. The condition of the field determined comfortable ground speed, reducing the rate of work when operating on rough ground. If bales were placed close together, the operator had to slow down or stop until the hydraulic operating sequences were completed. In general, the Kingsman could be fully loaded in about 11 minutes with twelve, 6 ft (1.8 m) bales. Loading fourteen, 5 ft (1.5 m) bales required about 13 minutes and the bale mover could be unloaded in about 5 minutes.

Capacity: The Kingsman 217 had a load capacity of 19,925 lb (9035 kg) or 9.9 tons (9.0 t) if the eight, 11L-15 tires were inflated to 36 psi (248 kPa), and a maximum travel speed of 25 mph (40 km/h). The Tire and Rim Association recommends a maximum load of 2930 lb (1328 kg) for each of the 11L-15 tires inflated to 36 psi (248 kPa). If the maximum speed was 10 mph (16 km/h) or less, the useful load would be 16,000 lb (7256 kg). Assuming the average density of a bale at 1400 lb (635 kg) the Kingsman 217 loaded with fourteen bales would exceed the tire load recommendations by 1.8 tons (1.6 t).

The 33.4 ft (10.2 m) bale beds allowed room for twelve bales, 6 ft (1.8 m) in length or fourteen bales 5 ft (1.5 m) in length. The lift arms were capable of lifting 2430 lb (1100 kg).

QUALITY OF WORK

Quality of work was very good. The Kingsman 217 did not impart aggressive action to the bales during loading. When loading with the quarter turn arm, the bales were gently lifted and rotated a quarter turn before lifting onto the bale bed. During loading the bales rolled from the lift arm forks onto the bale bed with the ground flattened spot in the up position and the previously weathered spot down. In this position, the bales would have less ability to shed moisture. The Kingsman 217 was effective in unloading bales in straight neat windrows. Reloading of windrowed bales from the rear was possible, however, the aggressive conveyor chains tended to break twine. Net wrapped bales were not reloaded in this manner.

EASE OF OPERATION AND ADJUSTMENT

Hitching: Ease of hitching was very good. The hitch clevis

was adjusted to suit tractor drawbar height and a suitable sized pin was inserted through the clevis and drawbar. A safety chain was not supplied with the 217 and the operator's manual does not list a safety chain as an option. It is recommended that the manufacturer consider supplying a hitch safety chain.

Four hydraulic hoses were coupled to the remote outlets of the tractor and the 12 volt electrical harness was attached with positive and negative leads to a 12 volt power source. A hitch jack was supplied to raise the hitch clevis to drawbar height. Hook-up was completed when the solenoid control buttons were fastened to the remote hydraulic control levers.

Loading: Ease of loading was very good. The Kingsman 217 was placed in field position by removing the lift arm safety locks and lowering the appropriate lift arm to the ground. Bales loaded with the standard lift arms were approached with their longitudinal axis parallel to the direction of travel. Just before the first bale was picked up, the bale forks were adjusted to ensure their proper width for the size of bales being handled. The Kingsman was moved ahead until the bale contacted the lift arm, the lift arm was raised and the bale rolled from the forks to the bale bed. The hydraulic motor for the conveying chains was activated and the bale was moved far enough to the rear to allow another bale to be loaded.

Bales loaded with the quarter turn lift arms were approached with their axis perpendicular to the direction of travel (FIGURE 2). Hydraulic action opened the fork, so the front fork was parallel to the direction of travel and the rear fork was perpendicular. As the bale wagon moved ahead, the open bale fork passed the bale. When the bale reached the rear fork, the front fork closed so that both forks were now parallel to each other but perpendicular to the direction of travel. The lift arm raised the bale off the ground and the two forks folded parallel to the direction of travel, thereby rotating the bale 90°. The lift arm continued to lift and rolled the bale onto the bale bed. The conveyor chain moved the bale far enough to the rear to allow loading another bale. This process continued until the load was completed.

Unloading: Ease of unloading was very good. Before unloading, the lift arms were lowered slightly so that the arms would not interfere with the bales as they were moved off the bale beds. The switch that controls the flow of oil between the lift arm cylinders and the deck tilt cylinder was energized and the deck was tilted slightly to allow some visibility to the rear (FIGURE 3). The bale mover was backed and stopped about 24 in (600 mm) from the previously unloaded bales. The deck was then tilted to its maximum, the tractor placed in its slowest forward gear and the conveying chains were engaged. The tractor was allowed to move forward at the same speed as the conveying chains were carrying the bales

off the bale beds. Once the bales were clear of the bale beds, the deck was returned to the load/transport position and unloading was completed. It took about 5 minutes to completely unload the bale mover.



FIGURE 3. Unloading Bales from the Kingsman 217.

Reloading: Ease of reloading was good. The Kingsman 217 was capable of reloading bales from the rear. The deck was tilted to the maximum elevation and the conveying chains were activated in reverse. The bale mover was then backed into the windrows of bales and they were reloaded in this manner. Usually some twine damage resulted from reloading the bales.

Transporting: Transporting was very good. When transporting, the lift arms should be raised to maximum height to reduce the overall width and the safety locks should be in place. Care had to be exercised when transporting on public roads as visibility to the rear was restricted. In general, the Kingsman was gentle with the bales and crop losses were minimal. The Kingsman provided good floatation over most fields and was stable when working on hillsides and ditches. The Kingsman 217 was manoeuvrable and was easy to back to previously unloaded bales. The 217 towed very well at speeds up to 18 mph (29 km/h). PAMI suggests that transport speeds of 18 mph (29 km/h) not be exceeded in order to stop a fully loaded bale mover within a safe distance.

Adjustments: Ease of adjusting the Kingsman 217 was very good. Adjusting the height of the clevis tongue was easy and consisted of removing the retaining bolts, moving the clevis to the desired height and reinstalling the retaining bolts. Hitch height adjustment consisted of turning the implement jack handle.

The standard equipment fork was adjustable for width to be compatible with the size of bales being loaded. The adjustment was easy and consisted of raising the fork slightly off the ground, loosening the clamping bolts on the forks and sliding the fork arms to the desired position and retightening the clamp bolts. Fork arm

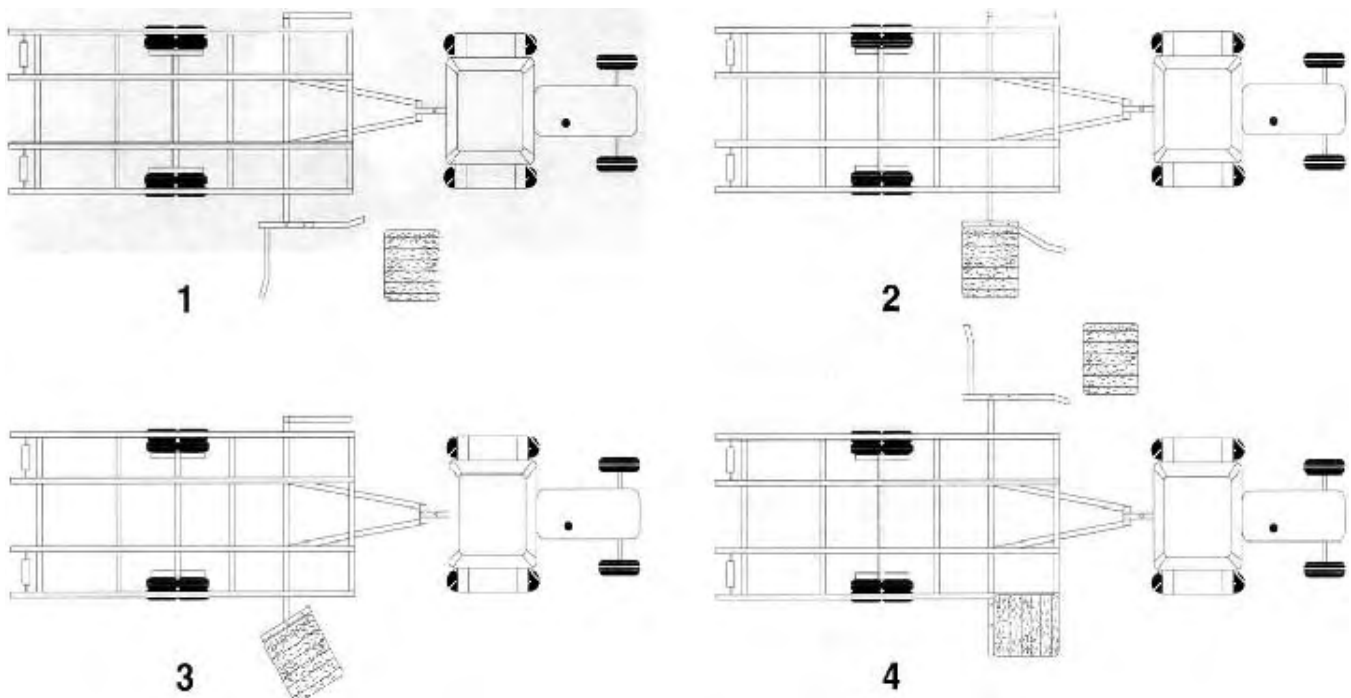


FIGURE 2. Quarter Turn Arm Operation.

adjustment took one person about 5 minutes.

Adjusting the fork arm on the quarter turn lift system was the same as the adjustment for the standard arm except only one fork arm was adjustable. Hydraulic function adjustments on the quarter turn arm were initially required to adjust the timing sequences. Adjustments for hydraulic cylinder speed were carried out by adjusting the flow control valves until the desired sequences and timing were achieved. Adjustments were easy and took one person about ten minutes.

Conveying chain adjustments were easy and consisted of turning the adjustment nuts located at the rear of the machine. Adjusting conveyor chain tension took one person about five minutes per chain.

Lubrication: Ease of lubrication was very good. All pressure grease fittings were easy to get at and took one person about ten minutes to service. In addition, the conveyor chains should be brushed with oil at the start of each workday.

POWER REQUIREMENTS

The operator's manual did not make a suggestion regarding the minimum size of tractor to be used. PAMI effectively operated the Kingsman 217 on level ground with a 110 hp (82 kW) tractor, even though the mass of the tractor was less than the mass of the loaded bale wagon. A tractor with additional mass would be required in hilly conditions. Although smaller tractors would have sufficient power to pull the fully loaded bale mover, they may not have enough weight to maintain positive control in the field or on the highway.

At a speed of 5.1 mph (8.1 km/h) it took 9.7 hp (7.3 kW) to keep the fully loaded bale mover rolling on a firm alfalfa field. The Kingsman required two remote hydraulic outlets capable of supplying 1500 psi (10.3 MPa) and a 12 volt electrical source. One circuit was required to operate the hydraulic cylinders, and the other was used to operate the twin hydraulic motors for the conveying chains. The standard lift arm and bale fork were powered by one double acting cylinder.

The optional quarter turn arm was powered with three double acting cylinders. The oil flow was controlled by a series of electrically powered solenoid valves and were energized by a 12 volt electrical supply from the towing vehicle. Hydraulic functions were selected by buttons located within the operator's reach.

OPERATOR SAFETY

Overall operator safety was very good if normal safety precautions were followed by the operator. Extreme care should be exercised when transporting on public roads as visibility to the rear is obscured by the load of bales. Additionally, when backing into the unloading site, the operator should dismount the tractor and check the area for obstructions. The fully loaded bale mover could be brought to a full stop in 34 ft (10.3 m) when travelling at 18 mph (29 km/h) on a level paved surface and towed with a 110 hp (82 kW) tractor. PAMI recommends operating the bale mover with a tractor of adequate size in order to have the required mass to safely control the bale mover. In hilly conditions a larger tractor would be required to have adequate control.

The test machine was equipped with a slow moving vehicle sign of the proper dimensions and decals were in place that would warn operators or bystanders of danger zones. The Kingsman 217 conformed to ASAE Standards for Safety.

OPERATOR'S MANUAL

The operator's manual was fair. The manual lacked detailed information on specifications, operations, adjustments, and safety. The book was not well organized or illustrated. The manual contained only basic instructions and was combined with a parts catalogue. It is recommended that the manufacturer consider supplying a more detailed operator's manual.

MECHANICAL HISTORY

The Kingsman 217 was operated for 108 hours in varying conditions and crops. During that period only a few mechanical problems were observed. The intent of the test was a functional evaluation and an extended durability test was not conducted. TABLE 2 outlines the mechanical history.

TABLE 2. Mechanical History

Item	Hours	Bales
-Flow control valve on quarter turn fork failed and was replaced at	1, 32	16, 533
-Quarter turn arm failed and was replaced at	32	533
-Slow Moving Vehicle sign broke when unloading at	41	642
-Right inside chain tension roller was damaged by conveyor chain and was replaced at	69	1019

DISCUSSION OF MECHANICAL HISTORY

Flow Control Valve: At 1 hour and again at 32 hours, the flow control valve that regulates the flow of oil to the quarter turn arm failed. Failure of both valves appeared to be identical (FIGURE 4). Cause of failure was not determined.

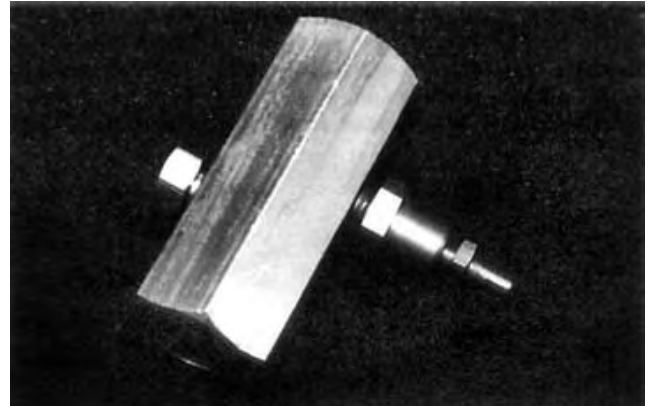


FIGURE 4. Flow Control Valve (Typical).

Quarter-turn Arm: The movable fork on the quarter turn arm fell to the ground and was bent as the result of hydraulic fluid loss when the flow control valve failed. The valve and arm were replaced at 32 hours and the problem did not recur.

Slow Moving Vehicle Sign: The slow moving vehicle sign was damaged when bales were unloaded. It is recommended that the manufacturer consider a modification that would prevent damage to the slow moving vehicle sign.

Chain Tension Roller: The right inside chain tension roller was damaged and replaced at 69 hours. Damage to the roller occurred when the roller loosened in its mounting bracket.

**APPENDIX I
SPECIFICATIONS**

MAKE:	Kingsman
MODEL:	RBM 217
SERIAL NUMBER:	79328
OVERALL DIMENSIONS:	
-- length	40 ft (12.2 m)
-- width	
-road	15 ft (4.6 m)
-field	19.5 ft (5.9 m)
-- bed	
-height	40 in (1000 mm)
-length	34 ft (10.3 m)
-- bed rail width	10.5 ft (3.2 m)
-- ground clearance	11.0 in (280 mm)
-- tires	eight, 11L-15
-- suspension	walking beam
HYDRAULICS:	
-- fork cylinders	
-bore	3.0 in (76 mm)
-stroke	14.0 in (355 mm)
-retracted length	24.2 in (615 mm)
-extended length	38.2 in (970 mm)
-- bed tilt cylinder	
-bore	3.0 in (76 mm)
-stroke	24.0 in (610 mm)
-retracted length	32.0 in (812 mm)
-extended length	56.0 in (1420 mm)
-- hydraulic motors	
-- displacement	11.3 in ³ (185 cm ³)
WEIGHT:	
-- right wheels	3190 lb (1447 kg)
-- left wheels	2640 lb (1197 kg)
-- hitch	1610 lb (730 kg)
total weight	7440 lb (3374 kg)
BED TILT:	10°
CONVEYOR CHAIN MATERIAL:	2052 H

**APPENDIX II
MACHINE RATINGS**

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

**SUMMARY CHART
KINGSMAN RBM-217**

RETAIL PRICE:	\$15,800 (October 1991; f.o.b. Portage la Prairie, MB optional quarter turn arm \$2,800 each)
RATE OF WORK:	In general it took 11 minutes to load and about 5 minutes to unload
-capacity	Twelve bales 6 ft (1.8 m) in length; fourteen bales 5 ft (1.5 m) in length; would carry 9.9 tons (9.0 t)
QUALITY OF WORK:	Very Good; did not impart aggressive action to the bales
EASE OF OPERATION AND ADJUSTMENT:	
-Hitching	Very Good; hook up was reliable & safe
-Loading	Very Good; easy to load
-Unloading	Very Good; easy to unload
-Reloading	Good; easy but damaged some twine
-Transporting	Very Good; minimal crop loss
-Adjustments	Very Good; most were very easy
-Lubrication	Very Good; easy to lubricate took about 10 minutes
POWER REQUIREMENTS:	PAMI effectively operated with a 110 hp (82 kW) tractor
OPERATOR SAFETY:	Very Good; was safe to operate if precautions were taken
OPERATOR'S MANUAL:	Fair; lacked detailed information
MECHANICAL HISTORY:	Only a few mechanical problems



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