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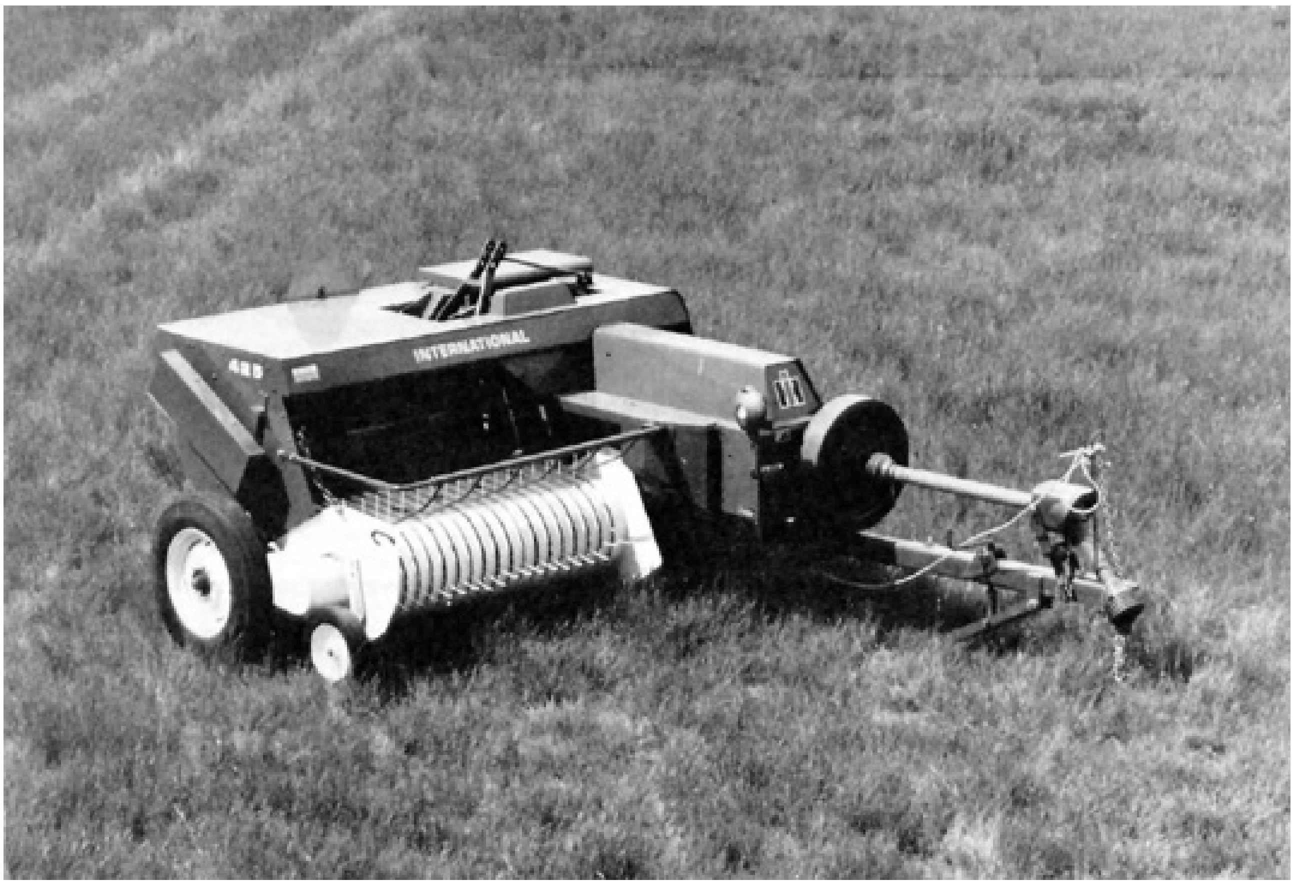

International Harvester Model 425 Baler

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

INTERNATIONAL HARVESTER MODEL 425 BALER

MANUFACTURER:

International Harvester Company of Great Britain Limited.
P.O. Box 25
259 City Road
London, England
EC1P 1AD

DISTRIBUTOR:

International Harvester Company of Canada Limited
10914 - 120 Street
Edmonton, Alberta
T5H 3P7

RETAIL PRICE:

$7964.34 (July, 1981, f.o.b. Lethbridge, complete with quarter turn bale chute, pickup gauge wheel, three joint power take-off shaft and long hitch, high floatation tires, safety chain and tool box).

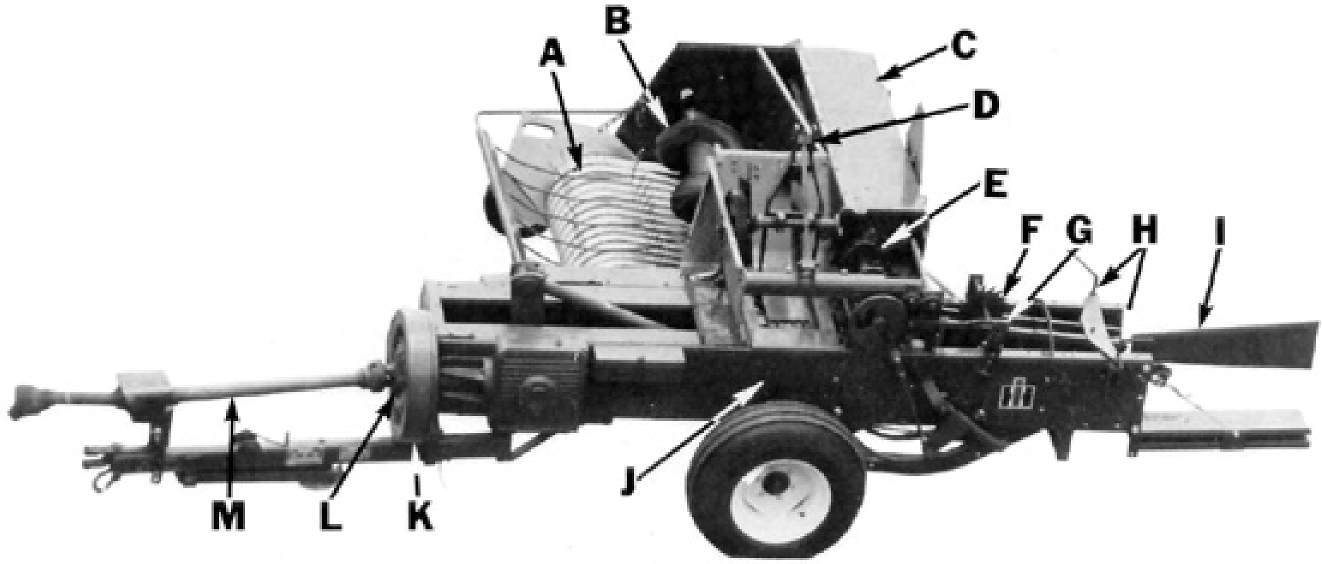

FIGURE 1. International Harvester 425 Baler: (A) Pickup, (B) Feed Auger, (C) Twine Box, (D) Packer Fingers, (E) Knotters, (F) Metering Wheel, (G) Metering Arm, (H) Bale Density Adjustment, (I) Quarter Turn Bale Chute, (J) Bale Chamber, (K) Flywheel, (L) Slip Clutch, (M) Power Shaft.

SUMMARY AND CONCLUSIONS

Overall functional performance of the International Harvester 425 baler *was good.*

Average feedrates varied from 2 to 8 t/h (2.2 to 8.8 ton/h). Field speeds were usually limited to 10 kmlh (6.2 mph) due to bouncing on rough ground and reduced pickup performance at higher speeds. Maximum instantaneous feedrates in excess of 16 t/h (17.6 ton/h) were measured in heavy uniform alfalfa windrows. Feeding was aggressive in most crops.

The International Harvester 425 was capable of producing firm, durable bales in most crops if additional bale wedges were installed in the bale chamber. In dry conditions or very light windrows, bale chamber density adjustment was inadequate to produce firm, dense durable bales. Length of the 356 x 457 mm (14 x 18 in) bales could be adjusted from 735 to 1320 mm (29 to 52 in). Bale length variation at the 1000 mm (39 in) setting, was about 120 mm (4.7 in). For a certain length setting, longer bales were usually produced at higher feedrates. Average hay bales weighed from 22 to 34 kg (48 to 75 lb), while average straw bales weighed from 18 to 23 kg (40 to 51 lb). Bale density var!ed from 142 to 200 kg/m^3 (8.6 to 12 lb/ft^3) in hay and from 103 to 141 kg/m^3 (6.2 to 8.5 lb/ft^3) in straw.

The International Harvester 425 was easy to operate and adjust. Knotter performance was very good with both sisal and synthetic twines.

Average power requirements were usually less than 19 kW (25 hp) but a 40kW (54 hp) tractor was needed to overcome power take-off fluctuations and to provide sufficient oower on hilly and soft fields.

Total leaf and stem loss was usually less than 3%, similar to that of other conventional square balers.

The International 425 was safe to operate if the manufacturer's safety recommendations were closely followed and normal safety precautions were obseryed.

Several mechanical problems occurred during the test. A set screw on the power take-off shaft was lost twice. The packer finger bearings failed, The packer finger guide rod retaining pin sheared, resulting in the packer fingers, guide rod, packer finger deflector plate and adjacent shielding being bent. In addition, two teeth on the packer finger crown gear chipped, and two pinion gear bearing mounting bolts sheared.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Improving the packer finger guide rod retaining cotter pin to prevent failure and damage to packer components.

Modifications to the bale chamber density adjustment to improve bale density and durability.

Chief Engineer: E. 0. Nyborg
Senior Engineer: E.J. Wiens
Project Engineer: R. K. Allam
Project Technologist: P. A. Bergen

MANUFACTURER STATES THAT

With regard to recommendation number:

1. This recommendation is being taken under consideration.
2. To increase bale weight, one additional tension spring (670 680 R1) may be added. This double spring configuration will allow higher bale density to be obtained.

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

GENERAL DESCRIPTION

The International Harvester Model 425 is a pull-type, 540 rpm, power take-off driven, automatic twine tie baler. A floating drum pickup delivers hay to the feed chamber, where it is fed into the 356 x 457 mm (14 x 18 in) bale chamber by an auger and packer fingers. Hay is compacted and bales formed by a slicing plunger operating at 75 stokes per minute.

FIGURE 1 shows the location of major components while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The International Harvester 425 was operated in a variety of crops (TABLE 1) for 103 hours while producing 15,990 bales. It was evaluated for rate of work, quality of work, power consumption, ease of operation, ease of adjustment, operator safety and suitability of the operator's manual.

TABLE 1. Operating Conditions

CROP	HOURS	NO. OF BALES
Alfalfa	35	6 220
Alfalfa, Bromegrass	16	1 960
Bromegrass	4	310
Greenfeed	4	970
Wheat Straw	22	3 430
Barley Straw	19	3 050
Oat Straw	1	50
TOTAL	103	15 990

RESULTS AND DISCUSSION

RATE OF WORK

Average feedrates varied from 2 t/h (2.2 ton/h) in light barley straw to 8 t/h (8.8 ton/h) in heavy alfalfa. Average feedrate depended on windrow size and uniformity, crop condition, field surface, available tractor speeds and operator skill. Speeds were normally limited to about 10 km/h (6.2 mph) due to bouncing on rough ground and poorer pickup performance at higher speeds.

In heavy, uniform alfalfa windrows, instantaneous feedrates in excess of 16 t/h (17.6 ton/h) were measured. These were peak values, representing maximum baler capacity, which could not be maintained continuously.

Feeding was aggressive in most crops. In heavy crops, feedrate was limited by shearing of the packer finger shear pin. In normal conditions the power take-off slip clutch slipped or occasionally the flywheel shear bolt failed. In very dry conditions, feedrate was limited by slippage of the pickup slip clutch.

QUALITY OF WORK

Bale Quality: The International Harvester 425 was capable of producing firm, durable bales in most crops (FIGURE 2). Bale chamber density adjustment was inadequate to form dense bales in short stemmed or very dry crops. In these conditions, the bales were poorly formed and of inadequate durability for bale wagon handling (FIGURE 3). Average hay bales weighed 22 to 34 kg (48 to 75 lb), while average straw bales weighed 18 to 23 kg (40 to 51 lb). Average bale density varied from 143 to 200 kg/m^3 (8.6 to 12.0 lb/ft^3) in hay and from 103 to 141 kg/m^3 (6.2 to 8.5 lb/ft^3) in straw.

A

B

C

D

FIGURE 2. Typical Bales: (A) Alfalfa, (B) Bromegrass, (C) Greenfeed, (D) Straw.

FIGURE 3. Poorly Formed Bale due to Inadequate Density Adjustment.

Bale Length Variation: As with most conventional square balers it was difficult to obtain consistent bale length, especially in non-uniform windrows. When set for 1000 mm (39.4 in) length, bale lengths typically varied from 940 to 1060 mm (37.0 to 41.7 in).

Bale length is adjusted by adjusting the metering arm stop bolt (FIGURE 4). The metering wheel advances the metering arm with each plunger stroke. Bale length uniformity depends on a consistent number of plunger strokes to form each bale. If the metering arm trips at the beginning of the last plunger stroke, rather than at the end of the stroke, bale length is increased by the length of compressed hay delivered during the last plunger stroke. Uniform feedrates are therefore important in reducing bale length variation.

For the same length setting, higher feedrates usually produced longer bales. For example, in a uniform alfalfa crop, average bale length was 1020 mm (40.2 in) when baling at 5 t/h (5.5 ton/h), but increased to 1060 mm (41.7 in) at 10 t/h (11 ton/h). In wheat straw the average bale length increased from 975 mm (38.4 in) at 3 t/h (3.3 ton/h) feedrate to 1200 mm (47.2 in) at 10 t/h (11 ton/h). This large variation in bale length in straw was attributable to inadequate bale density adjustment, resulting in larger, less dense charges for each plunger stroke.

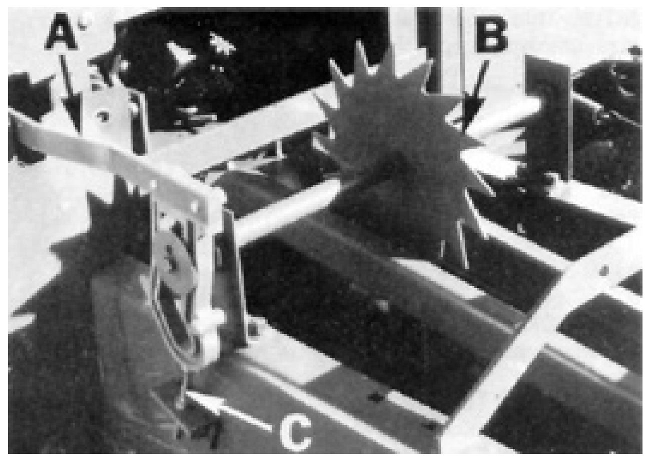

FIGURE 4. Bale Length Adjustment: (A) Metering Arm, (B) Metering Wheel, (C) Metering Arm Stop Bolt.

Leaf and Stem Loss: As with most conventional square balers, leaf and stem loss in dry hay was lower than with round balers. In most field conditions, total loss from the pickup and bale chamber was less than 3%. Pickup losses were normally insignifcant unless ground speed was very high or windrows were light and poorly formed.

Knotter Reliability and Performance: The knotters tied both sisal and synthetic twines very well with very few field adjustments. Occasionally, twine would tangle and catch at the twine guide loops located immediately above the balls in the twine box, resulting in twine tearing. Rethreading was then required.

POWER CONSUMPTION

Power Take-off Requirements: FIGURE 5 shows typical instantaneous power take-off requirements for the International Harvester 425. Power requirements fluctuated from 0 to 48 kW (0 to 64 hp) on each plunger stroke. Due to these wide power fluctuations, average power requirements were less than instantaneous requirements, varying from 5 to 19 kW (7 to 25 hp) over a full range of feedrates. FIGURE 6 shows the average power take-off requirements at various feedrates in alfalfa and wheat straw.

Tractor Size: The manufacturer made no recommendation as to tractor size. Average power take-off requirements were usually less than 19 kW (25 hp) and power required to pull the baler on level ground was usually less than 4 kW (5 hp). A 40 kW (54 hp) tractor was, however, needed to fully utilize baler capacity in soft hilly fields and to overcome the power fluctuations illustrated in FIGURE 5.

Specific Capacity: Specific capacity is a measure of how efficiently a machine performs a task. A high specific capacity indicates efficient energy use while low specific capacity indicates inefficient operation. The specific capacity of the International Harvester 425 varied from 0.6 to 1.2 t/kW.h (0.3 to 0.6 ton/hp.h) in alfalfa and from 0.8 to 0.9 t/kW.h (0.6 to 0.7 ton/hp.h) in wheat straw, this compares to an average specific capacity of 0.5 t/kW·h (0.4 ton/hp·h) for large round balers in alfalfa. These values represent average conditions and not peak output.

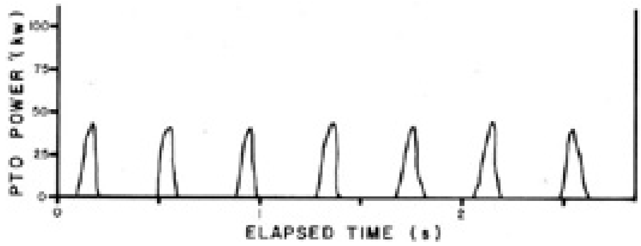

FIGURE 5. Instantaneous Power Take-off Requirements when Baling Alfalfa at 8 t/h Feedrate.

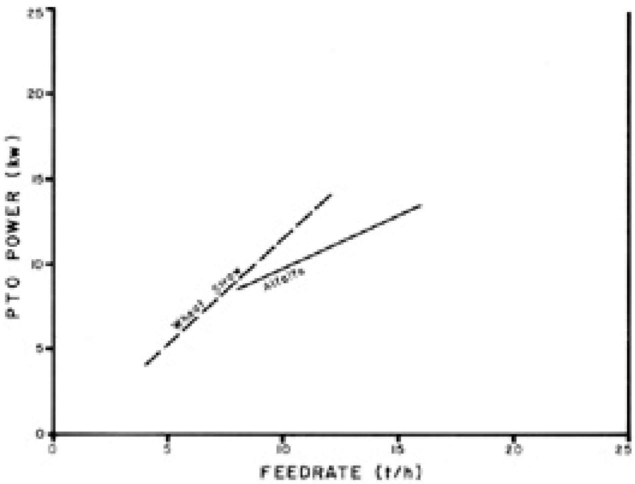

FIGURE 6. Average Power Take-off Requirements when Baling Alfalfa and Straw.

EASE OF OPERATION

Hitching: The International Harvester 425 was easily hitched to tractors equipped with a 540 rpm power take-off. The hitch jack was convenient for raising or lowering the hitch tongue. The power shaft pedestal and the hitch clevis were adjustable to suit various drawbar heights.

Transporting: The hitch tongue could easily be swung into transport or field position without getting off the tractor. Dismounting the tractor was necessary to fold the bale chute and raise the pickup. The International Harvester 425 could normally be placed into field or transport position in about two minutes.

The baler towed well behind a tractor or suitably sized truck.

Feeding: Feeding was agressive and positive in most crops. The pickup was wide enough to accommodate most well formed windrows with minimum trampling by the rear tractor tire. Pickup and feed chamber visiblility were excellent from most tractors.

Maneuverability: The International Harvester 425 was sufficiently maneuverable for efficient baling.

Twine Threading: Twine threading was convenient. The operator's manual gave a clear description of twine threading procedures and a twine threading diagram was provided on the twine box lid.

EASE OF ADJUSTMENT

Bale Length: Bale length was conveniently adjusted with a wrench. Bale length settings from 735 to 1320 mm (29 to 52 in) were possible. Obtaining a consistent bale length was difficult, since bale lengths varied, depending on windrow uniformity and feedrate.

Bale Density: Bale density was easily adjusted by hand cranks located at the rear of the bale chamber. Setting the cranks for a specific crop was a trial and error procedure and required the operator to dismount the tractor.

For most crops, the hand cranks provided insufficient adjustment range to produce dense bales unless additional bale wedges were installed in the bale chamber. The bale chamber had holes for installation of two sets of bale wedges. To obtain an adequate range of bale density adjustment, it was necessary to drill holes and install a third set of wedges. In dry conditions or very light windrows, the adjustment range, even with three sets of bale wedges installed, was insufficient to produce firm, durable bales suitable for bale wagon handling (FIGURE 3).

Only the top tension bar of the International Harvester 425 was adjustable. Most conventional balers involve both top and bottom tension bars in the bale density adjustment. In addition, the bale chamber length was about 130 mm (5 in) shorter than most comparable North American balers. It is recommended that the manufacturer consider modifications to the bale chamber density adjustment to improve bale density and durability.

Feeding System: The packer fingers had three settings which were adequate to provide well formed bales in most crops. However, in very dry greenfeed, packer finger adjustment was inadequate to produce well formed bales (FIGURE 7). The packer fingers were easily adjusted with a wrench.

FIGURE 7. Poorly Formed Bale in Greenfeed due to Inadequate Packer Finger Adjustment.

Pickup: The pickup height was easily set by positioning the chain on the hook (FIGURE 8). The pickup gauge wheel was positioned with the use of wrenches. The pickup windguard was not adjustable.

Overload Devices: The drive shaft slip clutch functioned well and required no adjustment during the test. Replacing the flywheel shearbolt was awkward due to poor accessibility,

The pickup slip clutch functioned well but required adjustment once during the test. It was easily adjusted with a wrench once the cover was removed. In heavy crops the packer finger shear pin sheared frequently, limiting overall capacity. The packer finger shear pin was easily replaced with pliers. The knotter shear bolt was convenient to replace.

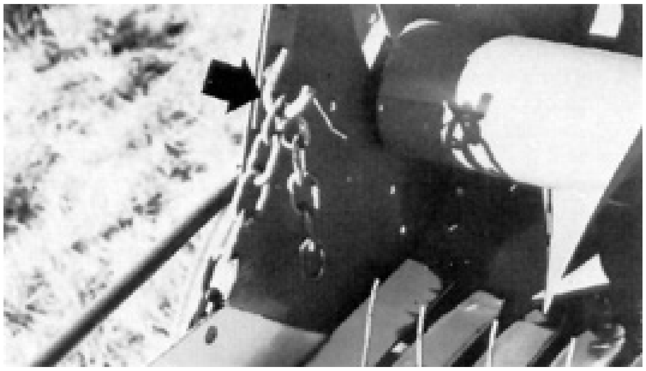

FIGURE 8. Pickup Height Adjustment.

Bale Chute: The optional quarter turn bale chute was easily adjusted to place bales on edge. Consistently placing the bales on edge was a problem in rough or hilly field conditions. The bale chute was reversible so bales could be dropped on either the left or the right.

Servicing: The International Harvester 425 had four drive chains, 28 grease fittings and one gearbox. The operator's manual recommended lubrication of 25 grease fittings every 100 hours or 3000 bales, three grease fittings every 50 hours or 15 000 bales and wheel bearing packing and inspection of the gearbox seasonally. About 12 minutes were needed for daily servicing of the International Harvester 425. All grease fittings were readily accessible.

Tool Box: A tool box located on the left side of the baler was convenient for carrying tools, shear bolts or spare parts.

OPERATOR SAFETY

The International Harvester 425 was safe to operate and service if normal safety precautions were observed. All moving parts, except for the flywheel, were well shielded. As with most power take-off equipment, the power take-off must be disengaged and the tractor engine stopped before adjusting or servicing.

OPERATOR'S MANUAL

The operator's manual was clear, well written and contained useful information on operation, servicing, adjustments and safety procedures. There was no lubrication schedule for the chain drives.

DURABILITY RESULTS

TABLE 2 outlines the mechanical history of the International Harvester 425 during 103 hours of field operation while baling 15,990 bales. The intent of the test was functional evaluation. The following failures represent only those which occurred during functional testing. An extended durability evaluation was not conducted.

TABLE 2. Mechanical History.

ITEM	OPERATING HOURS	EQUIVALENT BALES
DRIVE TRAIN		
-- Power take-off set screw was lost and replaced at	4, 22	310, 2930
PICKUP ASSEMBLY		
-- The pickup slip clutch was checked and adjusted at	18	2430
FEEDING ASSEMBLY		
-- The packer finger bearings failed and were replaced at	10	1270
-- The packer finger bearing bolts were changed as specified in a manufacturer's service bulletin at	10	1270
-- A raised edge on the packer finger was removed to prevent inteference with the deflector plate at	10	1270
-- The packer finger guide rod retaining cotter pin wore and was replaced at	15	1870
-- The packer fingers bent while rebaling broken bales and were straightened at	24	3110
-- The packer finger guide rod retaining cotter pin was replaced with a bolt at	52	8000
-- The packer fingers were bent and were straightened at	52	8000
-- The packer finger deflector plate and adjacent shielding bent and was straightened at	52	8000
-- Two teeth on the packer finger drive crown gear chipped and were repaired at	52	8000
-- The two bearing mounting bolts supporting the primary packer drive pinion gear sheared. The primary drive gears were retimed and the bolts replaced at	52	8000
PLUNGER		
-- The plunger and stationary knives were sharpened at	98	15,660
-- Plunger adjustments were checked, and the plunger adjusted to specificaitons at	98	15,660
BALE CHUTE		
-- The end of the bale chute deflector bent and was straightened at	98	15,660
BALE COUNTER		
-- The bale counter was not counting properly. The actuating spring was adjusted at	84	12,830

DISCUSSION OF MECHANICAL PROBLEMS

FEEDING ASSEMBLY

Packer Fingers: The packer finger bearings broke when the packer finger shear pin failed and a raised, saw cut edge on the packer fingers caught on the deflector plate (FIGURE 9). In addition, a manufacturer's service bulletin indicated that the packer finger mounting bolts had been incorrectly installed. The raised edge on the packer fingers was ground off and new packer finger bearings were installed according to the service bulletin. No further problems were encountered.

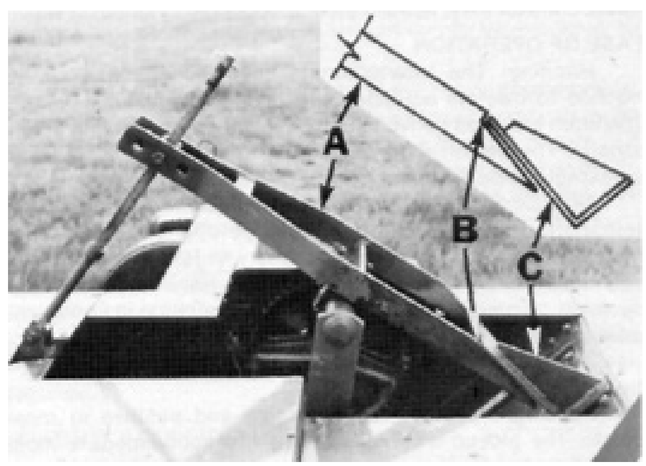

FIGURE 9. Packer Finger and Deflector Plate Interference: (A) Packer Finger, (B) Raised Saw Cut Edge, (C) Deflector Plate.

The packer finger guide rod retaining cotter pin (FIGURE 10) failed, due to repeated packer finger shear pin failure, allowing the packer fingers to come free of the guide rod. The packer fingers, guide rod, packer finger deflector plate and adjacent shielding were all bent (FIGURE 10). In addition, two teeth on the packer finger crown gear were chipped (FIGURE 11) and two pinion gear bearing bolts failed. All bent components were straightened, the chipped gear teeth were built up with weld and reshaped to their original dimensions, the bearing bolts were replaced and the drive gears were retimed. It is recommended that the manufacturer consider improving the packer finger guide rod retaining cotter pin to prevent failure.

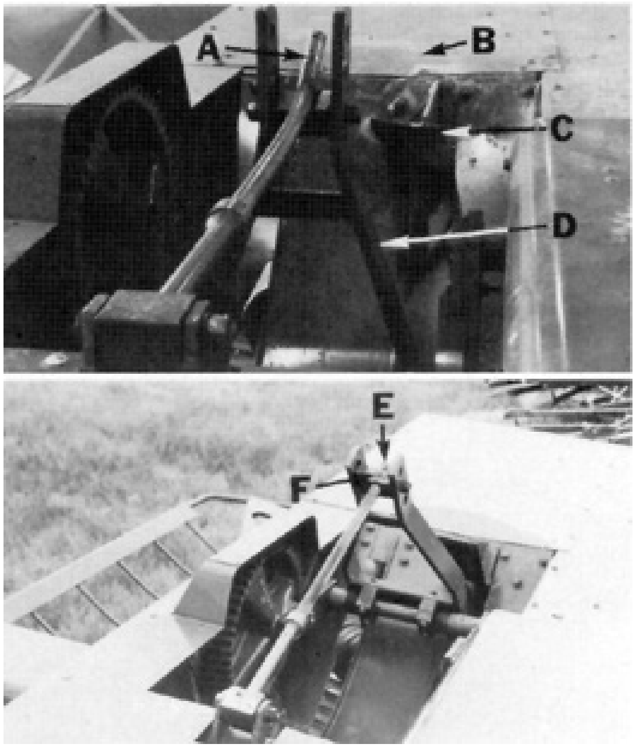

FIGURE 10. Bent Components due to Packer Finger Guide Rod Retaining Cotter Pin Failure: (A) Packer Finger Guide Rod, (B) Sheet Metal Shielding, (C) Deflector Plate, (D) Packer Fingers, (E) Retaining Cotter Pin, (F) Packer Finger Shear Pin.

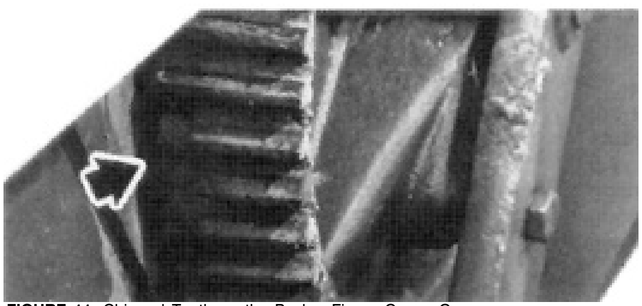

FIGURE 11. Chipped Teeth on the Packer Finger Crown Gear.

APPENDIX I

SPECIFICATIONS

MAKE:	International Harvester Baler
MODEL:	425
SERIAL NUMBER:	1764
OVERALL DIMENSIONS:	
-- width	2550 mm
-- length	5350 mm
-- height	1800 mm
-- ground clearance	200 mm
WEIGHTS:	
-- left wheel	753 kg
-- right wheel	381 kg
-- hitch	191 kg
Total	1325 kg
TIRES:	
-- left	10.0/75-15, 8 ply
-- right	6.50 - 16, 6-ply
-- pickup gauge	360 mm solid rubber on rim
PICKUP:	
-- type	cam actuated drum pickup
-- height adjustment	chain link adjustment
-- width	1480 mm
-- number of tooth bars	4
-- number of teeth	76
-- tooth spacing	72 mm
-- speed	75 rpm
FEEDING MECHANISM:	
-- type	auger and packer finger
-- auger diameter	402 mm
-- auger speed	203 rpm
-- packer finger speed	75 strokes per minute
PLUNGER:	
-- strokes per minute	75
-- length of stroke	710 mm
BALE CHAMBER:	
-- width	457 mm
-- height	356 mm
-- range of bale lengths	736 mm to 1320 mm
-- bale density control	compression bar (primary) side wedges (secondary)
TWINE CAPACITY:	4 balls
DRIVES:	
-- number of belt drives	1
-- number of chain drives	4
-- number of gear drives	4
-- number of universal joints	3
SAFETY FEATURES:	
-- Power take-off slip clutch	
-- flywheel shear bolt	
-- knotter drive shear bolt	
-- packer finger shear pin	
-- plunger safety stop	
-- pickup slip clutch	
SERVICING:	
-- grease fttings	25, serviced every 10 hours or 3000 bales
	3, serviced every 50 hours, or 15,000 bales
-- gearbox	1
-- wheel bearings	2
OPTIONAL EQUIPMENT:	
-- three-joint power take-off shaft*	
-- long hitch*	
-- pickup gauge wheel*	
-- remote pickup lift attachment	
-- quarter turn bale chute*	
-- high flotation tires*	
-- telescoping trailer hitch	
-- wagon loading chute	
-- bale thrower	
-- safety chain*	
-- tool box*	

*Supplied on test machine

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

CONVERSION TABLE

1 hectare (ha)	= 2.5 acres (ac)
1 kilometer/hour (km/h)	= 0.6 miles/hour (mph)
1 tonne (t)	= 2200 pounds mass (lb)
1 tonne/hour (t/h)	= 1.10 ton/hour (ton/h)
1 tonne/hectare (t/ha)	= 0.45 ton/acre (ton/ac)
1 millimeter (mm)	= 0.04 inches (in)
1 metre (m)	= 39.4 inches (in)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 kilogram (kg)	= 2.2 pound mass (lb)
1 kilogram/cubic meter (kg/m^3)	= 0.06 pounds mass/cubic foot (lb/ft^3)
1 tonne/kilowatt hour (t/kW·h)	= 0.8 ton/horsepower hour (ton/hp·h)

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