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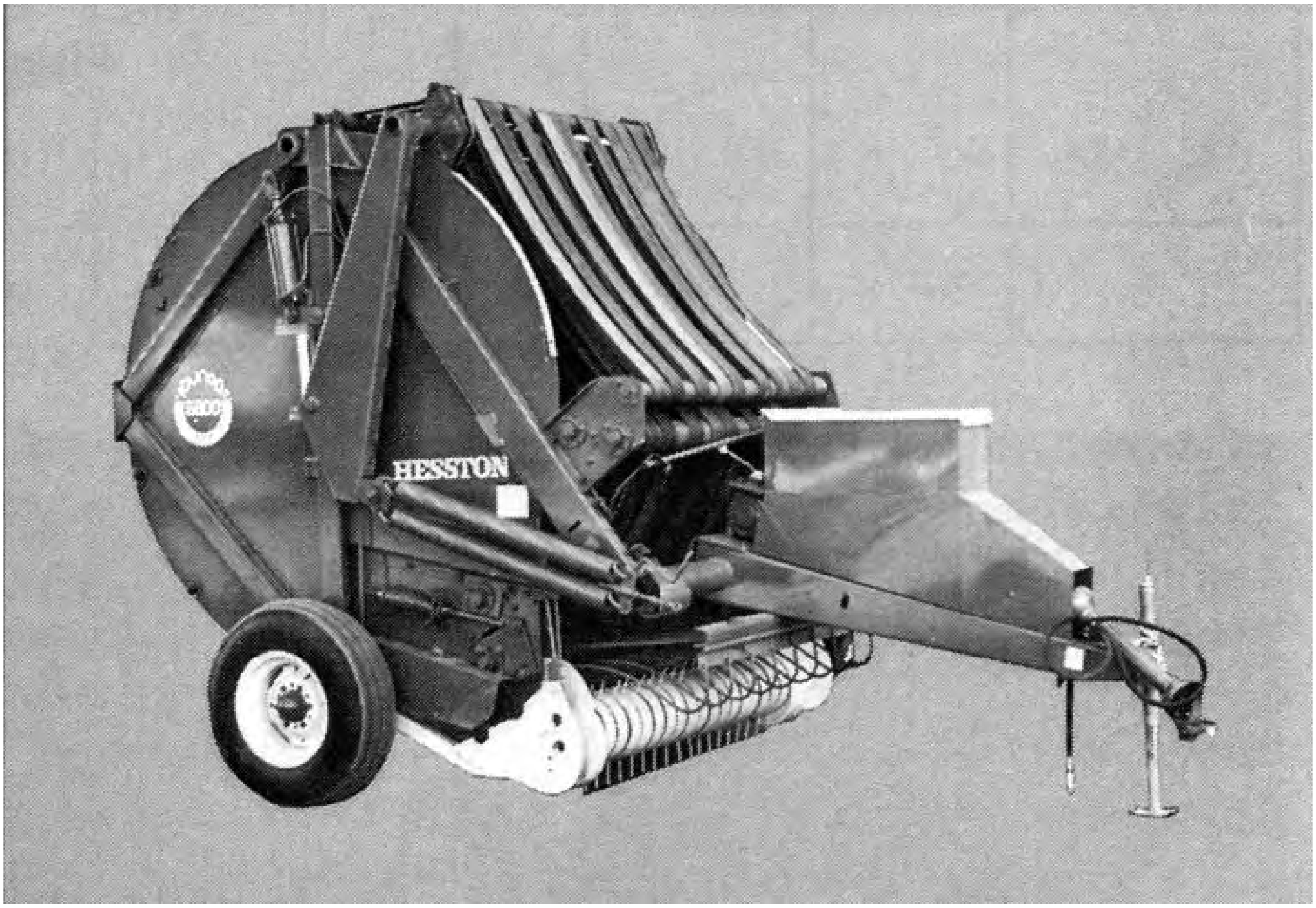
Evaluation Report 16



Hesston 5800 Rounder

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

HESSTON 5800 ROUNDER

Manufacturer:
Hesston Corporation
Hesston, Kansas 67062
U.S.A.

Distributor:
Hesston Industries Ltd.
920 - 26 Street N. E.
Calgary, Alberta
T2A 2M4

Retail Price:
$6685.00 (May, 1977, f.o.b. Humboldt)

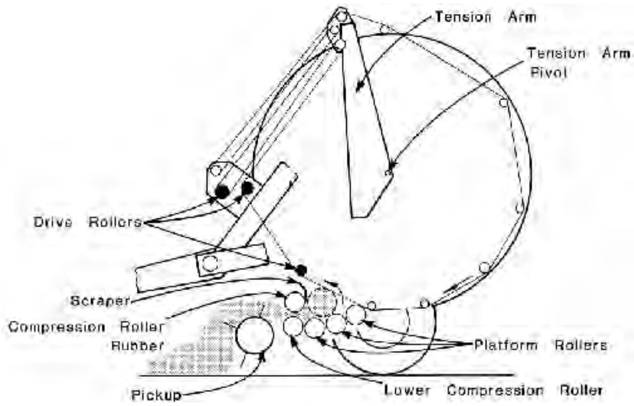


Figure 1. Schematic View of Hesston 5800 Rounder.

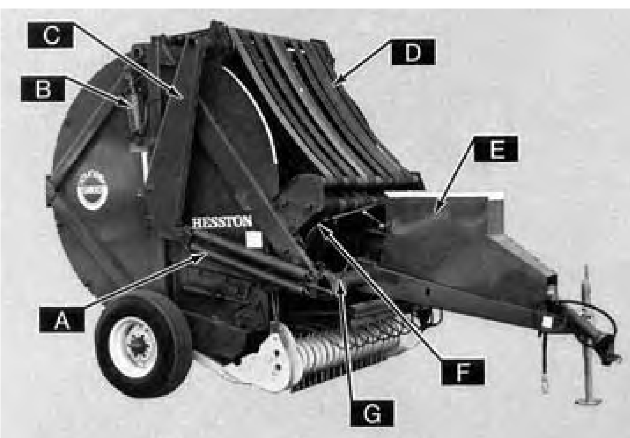


Figure 2. Front view of Hesston 5800 Rounder, Identification of Components: (A) Tension Spring, (B) Gate Cylinder, (C) Tension Arm, (D) Forming Belts, (E) Twine Box,(F) Twine Cutter, (G) Pickup Transport Lever.

Figure 3. Rear View of Hesston 5800 Rounder. Identification of Components: (H) Tension Springs, (J) Gate Cylinder, (K) Forming Belts.

Summary and Conclusions

Overall functional performance of the Hesston 5800 Rounder was good in most crops. Ease of operation was fair while ease of adjustment was good. Operation of the twine wrapping mechanism was fair.

Average field speeds varied from 8.0 to 10 km/h (5 to 6.2 mph) while average throughputs varied from 4.7 to 12.3 t/h (5.2 to 13.5 ton/h). Ground speed was usually limited by pickup loss and not by baler capacity. Feeding was aggressive in all crops but was reduced somewhat in long, coarse-stemmed sweet clover due to sluggish compression roller feeding.

Bales were well formed and neat in appearance. The Hesston 5800 produced bales with an average length of 1.5 m (60 in) and an average diameter of 1.8 m (70 in). Hay bales weighed from 780 kg to 895 kg (1720 to 1975 lb) with an average density of 225 kg/m³ (14.3 lb/ft³).

Peak power take-off requirements were about 19 kW (26 hp) in hay and 14 kW (19 hp) in straw.

Leaf loss was comparable to that of other large round balers. In heavy windrows, at optimum moisture content, bale chamber loss was less than 5% while in light, dry alfalfa, average bale chamber loss was 16% and pickup loss was 11%. Heavy windrows, proper conditioning and baling at the maximum permissible moisture content all were important in reducing bale chamber loss.

The Hesston 5800 was safe to operate if the manufacturer's recommendations on operation and adjustment were closely followed.

Recommendations

It is recommended that the manufacturer consider:

1. Modifying the compression roller scraper to eliminate scraper bending and to reduce feeding problems.
2. Redesigning the rear gate cylinder locks to improve operator safety.
3. Modifying the mount for the forming belt drive chain oiler to reduce mount failure.
4. Modifying the twine wrapping mechanism to improve cutter performance.
5. Relocating the hitch jack to improve operator safety.

Chief Engineer -- E. O. Nyborg
Senior Engineer -- L. G. Smith
Project Technologist -- D. H. Kelly

The Manufacturer States That

With regard to recommendation number:

1. A newly designed heavier scraper with spring release will be used on the 1977 model. The release is designed to prevent scraper damage if crop is forced into the opening.
2. This recommendation is under consideration at the present time. Difficulty is being experienced in designing a suitable attached stop for the vertical cylinder.
3. This has not been a serious problem with other balers in the field, and is not being considered at present.
4. An electrically actuated cylinder, which provides positive cutting action in all operating conditions, is being offered as an option in 1977.
5. A side operated hitch jack is being considered to prevent finger pinching.

General Description

The Hesston 5800 is a pull-type, power take-off driven baler with a cylindrical baling chamber and a floating drum pickup. The twine wrapping mechanism is manually actuated.

Hay is fed to the baling chamber between two compression rollers. The upper roller has a rubber surface while the lower roller is steel. The baling chamber consists of three full width platform rollers on the bottom and a set of nine 103 mm (4.1 in) wide forming belts on top. The platform rollers rotate in a fixed location while the spring loaded forming belts position themselves around the bale during formation.

Detailed specifications are given in Appendix I while Figures 1 to 3 show the location of major components.

Scope of Test

The Hesston 5800 was operated at 540 rpm with a David Brown 1412 tractor in the conditions shown in Table 1 for 118 hours while baling about 406 ha (1002 ac). 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	Crop Yield Range		Hours	Average Speed		Area Baled		Average Throughput	
	t/ha	ton/ac		km/h	mph	ha	ac	t/h	ton/h
Alfalfa, Bromegrass & Crested Wheatgrass	1.0 - 4.0	0.4 - 1.8	60.0	8.3	5.0	177	438	8.6	9.3
Alfalfa	0.5 - 5.0	0.2 - 2.0	13.5	8.0	5.0	50	123	9.5	10.5
Sweet Clover	3.0 - 4.0	1.3 - 1.7	8.0	6.0	3.7	18	44	7.9	8.7
Oat Straw	1.5	0.7	6.0	10.0	6.2	28	68	7.3	8.0
Barley Straw	1.5	0.7	12.5	10.0	6.2	38	143	7.3	8.0
Wheat Straw	1.0 - 2.0	0.4 - 0.9	5.5	8.5	5.3	21	53	6.8	7.5
Rye Straw	1.5	0.7	1.0	9.0	5.6	3	7	4.7	5.2
Flax Straw	1.3	0.6	1.0	10.0	6.2	9	23	12.3	13.5
Wheat & Barley Straw mixture	1.5	0.7	6.5	9.0	5.6	26	63	6.3	7.0
Oats & Sweet Clover Straw mixture	2.0	0.9	4.0	9.0	5.6	16	40	8.2	9.0
Total			118.0			406	1002		

Results and Discussion

RATE OF WORK

Average throughputs for the Hesston 5800 (Table 1) varied from 4.7 t/h (5.2 ton/h) in rye straw to 12.3 t/h (13.5 ton/h) in flax straw that had been cut with a 9100 mm (30 ft) windrower. In heavy, uniform, alfalfa, continuous workrates of about 13 t/h (14 ton/h) were possible and a bale could be formed in about three minutes. In addition it took about one minute to wrap the bale with twine and eject it.

In most crops, the maximum workrate was limited by pickup performance and not by bale chamber capacity. Pickup loss usually limited ground speed to a range of 8 to 10 km/h (5 to 6 mph). A heavy windrow was desirable to fully utilize baler capacity.

Feeding was aggressive in all crops except in long, coarse-stemmed sweet clover where capacity was reduced by sluggish feeding through the compression rolls.

QUALITY OF WORK

Bale Quality: The Hesston 5800 produced firm, durable bales (Figure 4) with fiat ends and uniform diameter. Bales averaged 1.5 m (60 in) in length and 1.8 m (70 in) in diameter. Average hay bales weighed from 780 to 895 kg (1720 to 1975 lb) with an average density of 225 kg/m³ (14.3 lb/ft³). Density at the outer diameter was about double that at the centre of the bale.

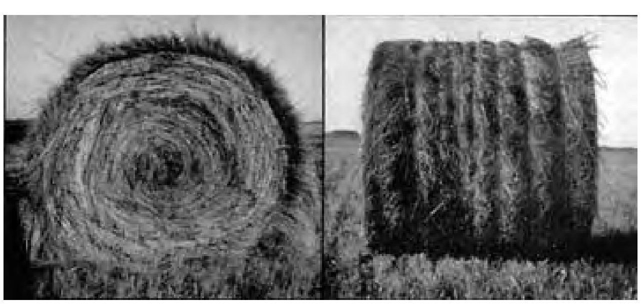


Figure 4. Typical Bales Formed by the Hesston 5800.

Leaf Loss: Total leaf loss for the Hesston 5800 varied from less than 5% in ideal windrows to 27% in light dry windrows.

In a field of 4.5 t/ha (2 ton/ac) alfalfa which had been cut with a 5500 mm (18 ft) windrower but which had not been conditioned, bale chamber losses were less than 5%. In this case, the windrow was heavy enough to fully utilize the capacity of the baler.

In another field of 1.2 t/ha (0.5 ton/ac) second cut alfalfa, which has also been cut with a 5500 mm (18 ft) windrower, average pickup loss was 11% while average bale chamber loss was 16%. The hay had not been conditioned and due to drying conditions in late August, the stalks were at a moisture content, which would just permit storage while the leaves were quite dry and brittle.

Bale chamber loss in a round baler depends on how long the bale is in the bale chamber. In the 1.2 t/ha (0.5 ton/ac) alfalfa crop it took about 15 minutes to form a bale while in the 4.5 t/ha (2 ton/ac) crop, a bale could be formed in about three minutes.

Research has shown that to minimize bale chamber losses with a round baler, windrows should be as heavy as possible, the hay should be conditioned to aid in stalk curing and moisture content should be at the maximum level which permits safe storage. Feedrate should also be as high as possible to minimize time in the baling chamber. It is often more economical to allow some pickup loss, by driving too fast, as the total loss level will be reduced due to a decreased bale chamber loss. Under ideal conditions, bale chamber loss may be as low as 0.5%. Bale chamber losses in light crops can also be reduced by running the tractor at a lower power take-off speed and in a higher gear to maintain proper ground speed. This results in fewer turns to make a bale. Power take-off speed must however be fast enough for satisfactory pickup performance.

Loss characteristics of small square balers are quite different. For square balers, bale chamber loss varies from about 2 to 5% regardless of windrow size or moisture content. With a large round baler, losses depend on how long a bale stays in the baling chamber since the hay is in constant agitation while the bale is being formed.

POWER CONSUMPTION

Power Take-Off Requirements: Figure 5 shows the power take-off input for the Hesston 5800 in alfalfa and in wheat straw. The power input is plotted against bale weight to show the power requirements as a bale is being formed. The power input varied from 3 kW (4 hp) at no load to a maximum of 19 kW (26 hp) in alfalfa and 14 kW (19 hp) in wheat straw.

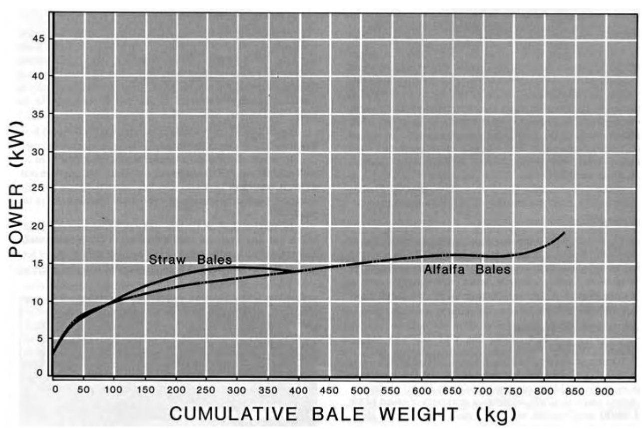


Figure 5. Power Consumption of the Hesston 5800 During Bale Formation.

Specific Capacity: The specific capacity is a measure of how efficiently a machine performs a task. A high specific capacity indicates efficient energy use while a low specific capacity indicates inefficient operation. The specific capacity of the Hesston 5800 was about 0.55 t/kW•h (0.45 ton/hp•h) in alfalfa and 0.50 t/kW•h (0.41 ton/hp•h) in straw. This compares to an average specific capacity of 0.98 to 1.45 t/kW•h (0.8 to 1.2 ton/hp•h) for a small square baler in alfalfa. These values represent average operating speeds in average field conditions and do not represent peak outputs.

EASE OF OPERATION

Forming a Bale: An inexperienced operator found some difficulty in starting a bale with the Hesston 5800 but once the operator gained experience, it was relatively easy to form a neat, durable bale. When starting a bale, it was necessary to weave the baler, back and forth across the windrow, so hay was fed evenly across the width of the baling chamber. The bale forming belts on the Hesston 5800 did not start to turn until the bale core was large enough to press against the belts and tighten them on the drive rollers. If the bale core did not have a uniform diameter when the forming belts began to turn, the belts on the smaller end of the bale core sometimes slipped past the end of the core and prevented proper bale formation. If this happened, the baler had to be stopped and the bale core ejected without twine. Once the bale core was properly formed, a slight weaving action was needed during bale formation to maintain a uniform bale diameter.

Figure 6 shows the position of the bale forming belts during bale formation.

Wrapping the Twine: A mechanical indicator at the front of the baler tells the operator when a bale is full size and ready for twine wrapping. The twine tube is controlled from the tractor with a rope.

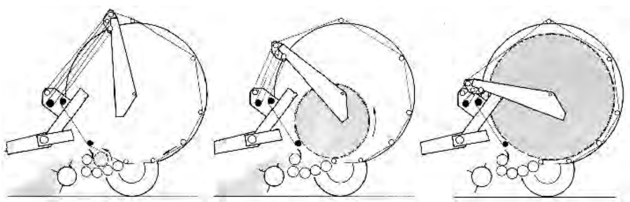


Figure 6. Stages of Bale Formation: (Left) Bale Core, (Centre) Half-Completed Bale, (Right) Completed Bale.

To start wrapping, the twine tube is pulled to the left of the bale chamber. Once the twine has been caught by the hay entering the feed rolls, the operator stops tractor forward travel but allows the power take-off to run. When the twine has made at least a full wrap around the left end of the bale, the operator then slowly releases the rope, allowing a return spring to pull the twine tube across the front of the bale chamber. The rate at which the rope is released determines the number of wraps around the bale. When the twine tube reaches the right side of the bale, the operator momentarily holds the rope so there is at least one complete wrap around the right bale end. The operator then pulls sharply on the rope and releases it. This permits the return spring to snap the twine tube into cut position and the twine is cut by a set of knives.

The twine tube sometimes did not return to cut position with enough force to cut the twine. The force applied to the twine tube by the twine feeding into the bale chamber opposed the force of the return spring. This problem could be prevented by stopping the power take-off when cutting the twine, however, the power take-off had to be reengaged momentarily, after cutting, to wrap the cut end. A stronger return spring may reduce this problem.

Twine consumption for the Hesston 5800 was about 53 m/t (159 ft/ton). This compares to a twine consumption of about 225 m/t (670 ft/ton) for small square balers.

Discharging a Bale: Once the twine is cut, the power takeoff is shut off and the tractor and baler are backed up about 6 m (20 ft). The rear gate is hydraulically opened, and the bale falls out of the bale chamber. The tractor and baler are then moved ahead about 4.5 m (15 ft) and the rear gate closed. A slight pressure is required on the gate hydraulic cylinders to ensure that the gate is fully closed. About one minute was needed to wrap and discharge a bale.

Transporting: The Hesston 5800 was easy to manoeuvre and transport. Ground clearance was adequate and there was ample hitch clearance for turning sharp corners. The baler could easily be towed behind a tractor or a small truck.

Hitching: The Hesston 5800 was easy to hitch to a tractor. If the tractor was equipped with a cab, it was sometimes difficult to find a suitable place for the twine tie rope to enter the cab and have the rope completely operative.

Feeding: Feeding was positive and aggressive in nearly all crops with only infrequent plugging. One exception was in very damp hay as sometimes encountered on the first round of a field. In very damp conditions, hay adhered to the compression roller and wedged between the upper compression roller and the scraper. Once hay wedged, the scraper usually bent, aggravating the problem. The scraper had to be removed and straightened three times during the test to reduce plugging problems.

In long, coarse-stemmed sweet clover, stalks occasionally fed up the front of the forming belts rather than through the compression rollers. This problem was not too severe and it was still possible to bale at a reduced feedrate.

Twine Threading: Twine threading was quite easy. Twine could be threaded without the use of a wire or additional aids.

The twine cutter performed well but the twine tube sometimes did not return to cut position with enough force to cut the twine. A stronger return spring on the twine tube is recommended.

EASE OF ADJUSTMENT

Compression Rollers: The upper rubber compression roller was held against the lower steel roller with adjustable springs. The operator's manual gave the recommended spring length to provide proper contact pressure. All evaluation was conducted with the specified spring length.

Forming Belts: Two adjustable springs maintain tension in the forming belts. No spring adjustment was required during the test once the springs had been set to the manufacturer's recommended length.

The forming belts were chain driven through the upper roller. The drive chain also powered the lower compression roller. Due to the length of the chain, excessive heat build up occurred unless the chain was properly lubricated. The chain was equipped with a wick type oiler. The oiler was effective in lubricating the chain but the oiler mount loosened or broke on several occasions. A more durable oiler mounting bracket is required.

Platform Rollers: The platform rollers on the Hesston 5800 were not adjustable. Rollers were chain driven from the lower compression roller and eccentric chain tighteners were provided.

Pickup: Pickup flotation was controlled with an adjustable spring which also was used to set pickup ground clearance. The operator's manual recommends a 25 mm (1 in) clearance between the pickup tines and ground. No adjustments were needed during the test. The drive belt had a spring loaded tightener and needed no adjustment.

The pickup tines are cam controlled and can be adjusted to advance or retard the pickup tine pattern. Pickup tine timing adjustment is outlined briefly in the operator's manual. The pickup tines could be adjusted for very aggressive picking action however, in stony fields, many stones were picked at all settings. Numerous stones were thrown at the operator by the pickup and on three occasions, stones jammed between the compression rollers.

The pickup compression bars consisted of two separate assemblies, a fixed set of eight bars and a hinged set, which floated on top of the windrow. The floating bar assembly was adjustable for height above the pickup and could also be removed. Feeding in very fluffy windrows was improved by removal of the floating bar assembly. The floating bar assembly was effective in all other crops.

Servicing: The Hesston 5800 had four chain drives, 13 grease fittings, and one gearbox. The operator's manual recommended chain oiling every four hours, lubrication of all grease fittings every eight hours, and checking gear box oil level and repacking the wheel bearings every season. About 15 minutes were needed to service the Hesston 5800.

OPERATOR SAFETY

The Hesston 5800 was safe to operate and service as long as common sense was used and the manufacturer's safety recommendations were followed. Rotating parts were well shielded.

Two hazardous situations were encountered when baling in stony areas. The pickup occasionally threw small stones towards the tractor and the operator. The operator's manual recommends that safety glasses be worn in stony fields. Another hazardous situation occurred when the pickup fed large stones into the compression rollers. Stones wedged between the compression rollers, either stopping them or scraping on the steel roller and emitting sparks. Figure 7 shows two rocks, which wedged in the compression rollers. One of these started a fire from the sparks generated. The operator's manual recommends that a fire extinguisher be mounted on the baler.

The Hesston 5800 had rear gate cylinder locks to permit safe servicing while the rear gate was open. The gate locks were not part of the hydraulic cylinder, and therefore had to be removed from their storage position and manually placed on the cylinder rods. A system where the gate locks pivot about the upper cylinder rod pin is desirable since increased convenience will likely increase usage. The hitch jack on the Hesston 5800 was positioned so that the operator hit his hand on the baler sheet metal when raising or lowering the hitch. Moving the jack stand ahead about 25 mm (1 in) would give ample jack handle clearance.

Figure 7. Typical Size of Rocks, Which May Wedge Between the Compression Rollers.

GENERAL SAFETY COMMENTS

The operator is cautioned that a round baler is potentially very dangerous. The operator must disengage the power take-off and stop the tractor engine to clear blockages or to make adjustments.

Many serious and fatal accidents have occurred with round balers. Most of these are caused by operators dismounting from the tractor while leaving the baler running. The manufacturer can only go to certain limits in providing shielding and safety devices and must rely on the operator's common sense in following established safety procedures.

OPERATOR'S MANUAL

The operator's manual was clear and well written, containing much useful information on operation, servicing, adjustment, and safety procedures.

Durability Results

Table 2 outlines the mechanical history of the Hesston 5800 during 118 hours of field operation while baling about 406 ha (1002 ac). 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	Hours
-The power take-off shaft moved in its bearings towards the rear of the baler and was repositioned at	15, 39, & 48
-The compression roller scraper bent and was straightened at	19, 26, & 48
-The forming belt drive roller bearing failed and was replaced at	19
-The forming belt drive chain oiler mount broke and was replaced at	49
-The upper compression roller drive sprocket gib key was lost and replaced at	60

Discussion of Mechanical History

Power Take-Off Shaft Assembly: On three occasions, the power take-off shaft assembly moved rearward in its bearing (Figure 8). The bearing lock collar did not prevent shaft movement. Damage to the rear universal joint would occur if the shaft assembly drifted too far.

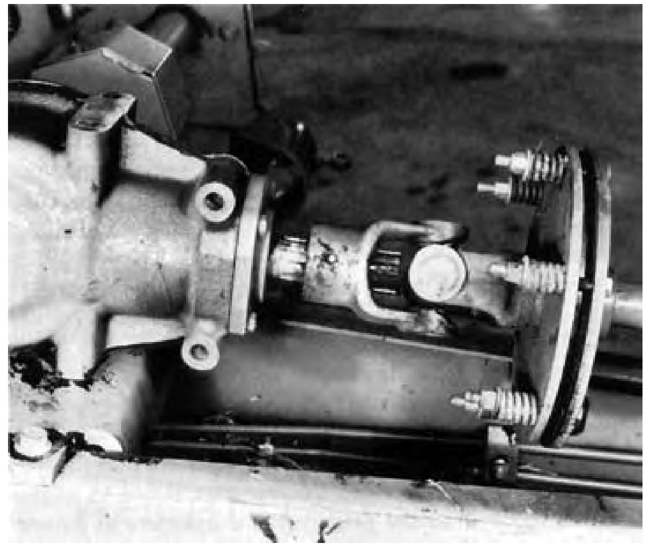


Figure 8. Movement of Power Take-Off Shaft.

Compression Roller Scraper: In very damp conditions, wet hay adhered to the compression roller and wedged between the upper compression roller and scraper causing the scraper to bend. The scraper had to be removed and straightened three times.

APPENDIX I
SPECIFICATIONS

Make:	Hesston Model 5800 Rounder
Serial Number:	RB58-2879
Overall Dimensions:	
-- Ground clearance	190 mm (7.5 in)
-- Width	2390 mm (94.1 in)
-- Height	2590 mm (101.9 in)
-- Length	4000 mm (157.5 in)
Tires:	2, 9.5 L x 15, 6-ply
Weight (with drawbar in field position and two balls of twine):	
-- Left wheel	762 kg (1679 lb)
-- Right wheel	710 kg (1565 lb)
-- Hitch point	322 kg (709 lb)
Total weight	1794 kg (3953 lb)
Bale Chamber:	
-- Width	1530 mm (60.2 in)
-- Maximum diameter	1920 mm (75.6 in)
-- Bottom rollers	
-number of rollers	3
-diameter of rollers	155 mm (6.1 in)
-length of rollers	1530 mm (60.2 in)
-roller composition	2 steel, 1 rubber
-roller speed	290 rpm
-- Forming Belts	
-number of belts	9
-belt width	103 mm (4.1 in)
-belt length	12,192 mm (480 in)
-thickness	4 mm (0.16 in)
-spacing (centre to centre)	50 mm (2.0 in)
-belt speed	2.3 m/s (90 in/sec)
-- Bale chamber tension method	Spring
-- Bale size indicator	Mechanical linkage
Compression Rollers:	
-- Number of rollers	2
-- Roller composition	1 steel, 1 rubber
-- Length	Upper - 1524 mm (60 in Lower - 1524 mm (60 in)
-- Diameter	Upper - 152.4 (6 in) Lower - 152.4 mm (6 in)
Pickup:	
-- Type	Semi-floating drum with spring teeth
-- Height adjustment	Adjustable stops
-- Width	1470 mm (57.9 in)
-- Number of tooth bars	3
-- Tooth spacing	95 mm (3.7 in)
-- Speed	195 rpm
Twine system:	
-- Capacity	3 balls
-- Recommended twine size	None
-- Twine feed and cutter	Manual
Safety Devices:	Adjustable PTO slip clutch, rear gate locks, rear gate hydraulic relief valve
Servicing:	
-- Grease fittings	13, every 8 hours
-- Gear box	1, seasonal
-- Chains	4, every 4 hours
-- Wheel bearings	2, yearly

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 conversion may be used:

1 hectare (ha)	= 2.47 acres (ac)
1 kilometre/hour (km/h)	= 0.62 miles/hour (mph)
1 tonne (0 = 2204.6 pounds (lb)	= 1.10 ton (ton)
1 tonne/hour (t/h)	= 1.1 ton/hour (ton/h)
1 tonne/hectare (t/ha)	= 0.45 ton/acre (ton/ac)
1000 millimetres (mm) = 1 metre (m)	= 39.37 inches (in)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 kilogram (kg)	= 2.20 pounds (lb)
1 tonne/kilowatt hour (t/kW•h)	= 0.82 tons/horsepower hour (ton/bp•h)

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