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Howard Bigbaler

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Modification, Setup and Operation when Baling Thatching Straw

Prepared by ***SCARLETT RESEARCH LTD***

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This is one of a series of thatching straw machinery technical guides prepared by Scarlett Research Ltd on behalf of Historic England and Historic Environment Scotland *(see Section 14)*. It is intended to provide an informative overview, **not** a comprehensive reference.

It should be used to compliment the Howard Bigbaler Operator Instruction Manual *(see Section 13 for download details)*, **not** as a substitute for it.

Machine Safety

Some images and video clips shown in this guide for illustrative purposes have been obtained by remotely-operated cameras located close to moving machinery. The viewing locations used are not necessarily safe for human presence during machine operation. Please therefore:

- **NEVER** approach the baler when it is under power / in motion
- **ALWAYS** disengage the tractor power take-off (p.t.o.), apply the parking brake and stop the tractor engine before leaving the tractor cab
- **ALWAYS** ensure the baler's Packing Fingers are in the *(lowest)* **'Bottom Dead Centre'** position **and** the Packing Plate is fully forward **BEFORE** climbing onto or into the baler *(see Fig.5.1)*
- **ALWAYS** ensure all safety guards are in good condition **and** in place when the baler is under power.

Disclaimer

This guide is intended for users who are competent in the operation & adaptation of machinery. Users should take all necessary safety precautions and pay due regard to the safety warnings contained herein.

The information presented is intended for information and guidance purposes only and may be subject to change without notice. Whilst every effort has been made to ensure the information is both relevant and accurate, neither Scarlett Research Ltd nor Historic England nor Historic Environment Scotland will accept any liability for any error or omission, or reliance on any part or all of the content of this guide, or any associated written or oral advice given, in any context.

Information presented regarding legislation is based upon our current understanding of the law, which may change and is not definitive: only the courts may interpret legislation definitively. It may be necessary to seek advice on individual circumstances.

Acknowledgements

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Contents

1 Introduction

Purpose

When first introduced in 1972, the Howard Bigbaler was the first large square baler (LSB) on the UK market. Today Howard Bigbalers are used by a considerable number of UK thatching straw growers, to package unthreshed sheaves into large bales, to aid rapid field clearance and subsequent crop handling & transportation with minimal labour input.

Fig.1.1 Unmodified Mk2 Bigbaler baling combined straw

Thatching straw growers have found that the Bigbaler can operate more effectively if it is modified slightly and particular operating techniques are used. Until now this knowledge, gained through many years of practical experience, has never been collated.

Howard Bigbalers never had the best reputation for reliability, even when brand-new. The passing of over 50 years hasn't really changed this, but Bigbaler users have identified particular areas of weakness and important preventative steps to minimise breakdowns.

So, the purpose of this technical guide is to help thatching straw growers:

- Get best performance from the Bigbaler: both in terms of output and reliability
- Minimise straw damage during baling

This requires two distinct but complementary approaches:

- **Machine Modification(s)**:
  - To make the standard Bigbaler more suited to the task of baling thatching straw *(in sheaves)*
  - To minimise crop damage & improve straw quality
- **Machine Operation**:
  - Bigbaler setup to get the best from the machine
  - Best-practice operating techniques when baling thatching straw

This guide is intended to provide an informative overview, **not** a comprehensive reference. It should be used to compliment your Bigbaler's Operator's Instruction Manual, **not** as a substitute for it. Don't worry if you don't have an Instruction Manual or Parts List: these can be downloaded via the links provided in Section 13.

Conventions and Units Used by this Guide

Left and Right As viewed from the tractor seat *(or from behind the baler)*, facing forwards

Imperial or Metric? The Bigbaler was originally designed at a time when imperial units were the norm, but later versions featured a mix of imperial and metric components. This guide always shows both metric & imperial units: whichever is shown first is believed to be the original unit of measurement used.

Safety Precautions and Statutory Requirements

The Bigbaler was originally well-guarded and safety compliant, but it's now 45-50 years old. The following safety legislation applies to its use today. Penalties for failing to comply can be severe, but the human cost can be far higher.

- **Health & Safety at Work Act (1974) *(HSWA)*:** Applies to anyone who supplies *(sells or hires)* equipment for use at work *(whether new or second-hand)*. It also places duties on the user/employer. Essentially, it requires that all equipment supplied to or used in the workplace must be safe for use.
- **Provision and Use of Work Equipment Regulations (1998) *(PUWER 98)*:** Primarily apply to the machine user *(employer, employee or self-employed)*. Require that any equipment provided for use for work must:
    - Be safe for use
    - Be suitable for the intended use
    - Be properly maintained in a safe condition
    - Feature suitable safety control measures *(i.e. guards, markings & warnings)*

  Additionally, the machine user must be adequately trained/instructed and be provided with appropriate information to enable safe use of the machine.

SAFETY WARNING

The operation, maintenance and repair of power (p.t.o.) driven agricultural machinery creates risks which need to be managed, so:

PLEASE BE AWARE OF THE RISKS, ASSESS THEM AND TAKE APPROPRIATE STEPS TO MANAGE THEM

Do's and Don'ts

- **OBTAIN**, read and make sure you understand the baler's Operator's Manual *(see Section 13)*
- **ALWAYS follow the SAFE STOP procedure:** Before leaving the tractor cab to make any repairs or adjustments:
    - **Disengage** the tractor power take-off (p.t.o.)
    - **Apply** the parking brake
    - **Stop** the tractor engine

  If leaving the tractor unattended *(to work on the baler)*, **also Remove** the tractor ignition key
- **ALWAYS** ensure the baler's Packing Fingers are in the *(lowest)* **'Bottom Dead Centre'** position **and** the Packing Plate is fully forward **BEFORE** climbing onto or into the baler *(see Fig.5.1)*
- **ALWAYS** ensure all safety guards are in good condition and in place when the baler is in work
- **BEWARE** of the unique risks the Bigbaler poses to the Operator **and** Bystanders:
    - Exercise great care when manoeuvring the baler in-field – Especially when reversing
    - **Keep Bystanders away** from the machine when it's in operation – **Particularly the tailgate.**

2 Howard Bigbaler - History

The Bigbaler was invented and developed in 1967 by two Gloucestershire farmers, Pat Murray and his brother-in-law David Craig. Prior to the widespread adoption of silage making, in the late-1960s many dairy herds relied on high-quality hay to maintain milk yields. Unfortunately, the weather didn't always play ball and so artificial barn-drying of hay was seen as a possible solution.

Messrs Murray and Craig needed a crop packaging system which could clear a field quickly *(before the weather turned)*, could be mechanised to avoid manual handling, and which produced low-density bales to allow air to pass through during fan-assisted drying. The baler didn't exist, so they designed and built one.

Young, soft hay requires delicate treatment during baling to avoid leaf loss and the bales couldn't be too tight or they wouldn't dry properly. This limited bale density and compromised bale shape but, by chance, also created a machine well-suited to the needs of packaging thatching straw with minimum damage.

The Bigbaler invention was licensed to the Howard Rotavator Co. Ltd, who produced their first prototype in 1969. Many more prototypes were built, tested on farms and refined before the Howard Bigbaler was officially launched in autumn 1972, ready for the 1973 *(hay & straw)* season.

Only 50 machines were made available in 1973 but many suffered mechanical problems, necessitating a factory refit campaign before the 1974 season. The Bigbaler design was subject to yet more modifications and refinements for the 1975 and 1976 seasons.

A revised and upgraded Mk2 Bigbaler was released for the 1977 season, incorporating the previous improvements plus other detail re-designs.
But users no longer wanted a baler for barn-dried hay, but rather one which could produce firm & robust rectangular bales. The Bigbaler was increasingly being pushed beyond its original design.

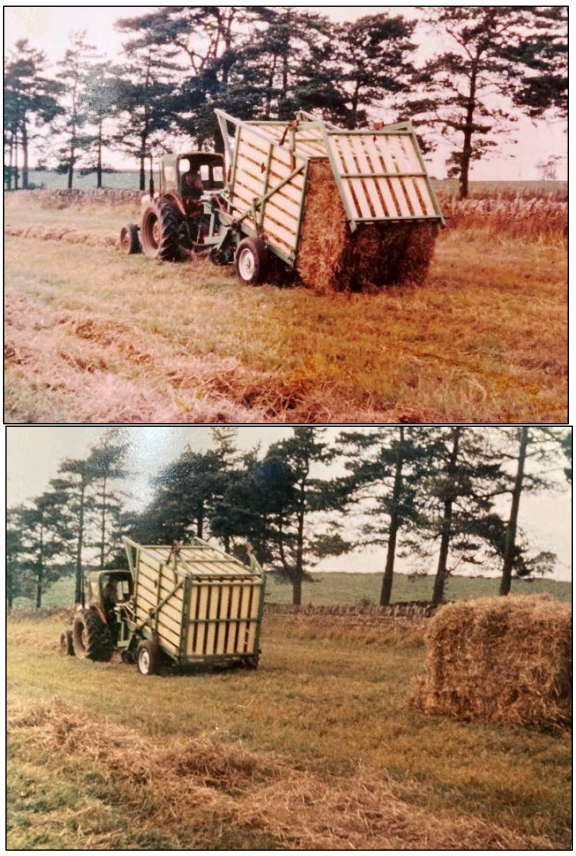


Fig.2.1 Original farmer-built Bigbaler at work in Gloucestershire - 1967 *(courtesy F. Craig-Brooker)*

Fig.2.2 Howard Bigbaler press launch - autumn 1972 *(courtesy Howard Rotavator Co.)*

Bigbaler production began at Howard's West Horndon *(Essex)* premises, but soon moved to a newly-built factory in Halesworth *(Suffolk)* which employed ~600 people. Unfortunately, Howard's UK business suffered during the late-1970s, resulting in the closure of the Halesworth factory and the end of Bigbaler production in late-1980. The remaining stock of machines was re-furbished and sold off in 1981-82. Howard Rotavator Co. Ltd went into receivership in autumn 1985.

3 Howard Bigbaler – How It Works

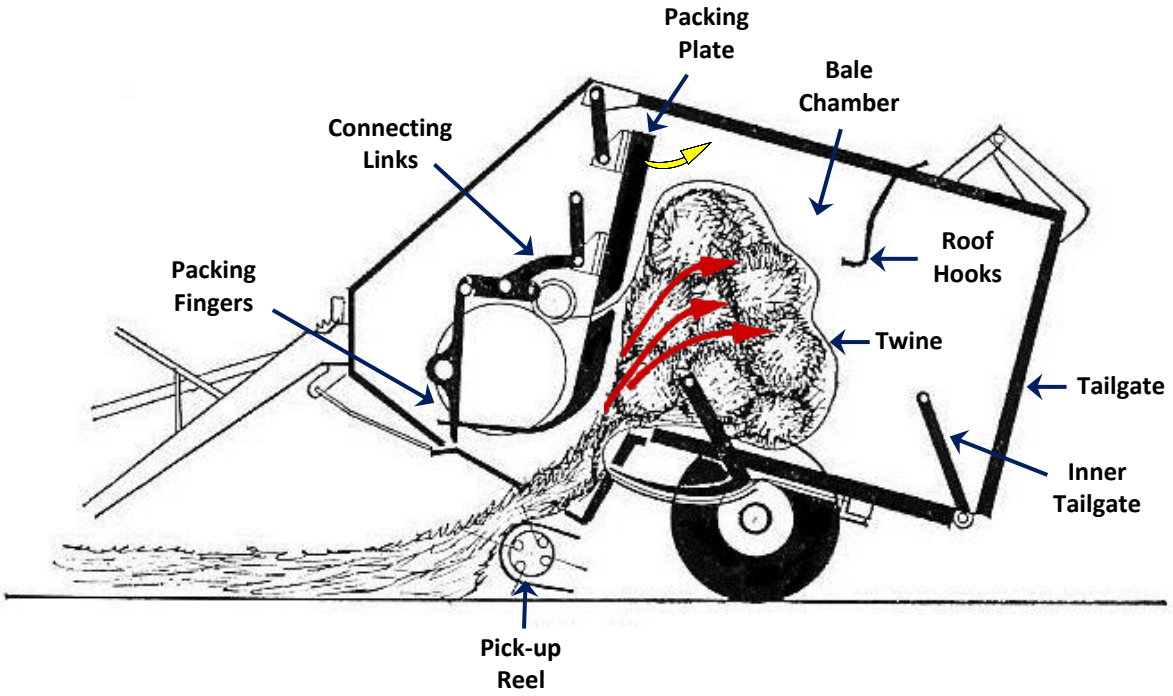
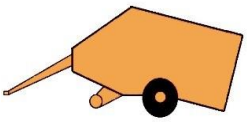


Fig.3.1 Howard Bigbaler *(cross-sectional view)* – Early stages of bale formation

The Bigbaler is a p.t.o.-powered, low-density 'press'-type baler: rather like a cross between a baler and a forage wagon. It is towed in-line behind the tractor, which straddles the swath to be baled. It produces 8 ft (2.4 m) long bales of 5 ft x 5 ft (1.5 m x 1.5 m) cross-section, which weigh 450-700 kg in hay and 250-350 kg in straw. Howard Bigbales are not perfectly rectangular: a 'bread loaf' description is fairly accurate. But their low density is an advantage when packaging thatching straw.

Unlike other square balers, Bigbaler baling is not a continuous process. As with round balers, it is necessary to pause momentarily to tie the bale before discharge. Also, like a fixed-chamber round baler, bale density ultimately depends on how much material is packed into the *(fixed dimension)* bale chamber.

Click on the Baler icon or scan the QR code for video of Bigbaler operation



In work the crop is lifted from the swath by a conventional 5 ft / 1.5 m-wide tined pick-up reel and transferred to the baler's feed passage or 'throat'. From here a bank of nine packing fingers, operating in a semi-rotary motion, move the crop in discrete bundles up through the throat and into the front of the bale chamber *(Fig.3.1)*.

The entire front wall of the bale chamber *(the Packing Plate)* is suspended from the baler's main frame on four swinging links. The linkage which controls the motion of the gear-driven packing fingers is also connected to the packing plate so that, as the packing fingers return to collect more material from the pick-up, the packing plate is pushed **both rearwards and upwards** into the bale chamber, thereby lifting and compressing the crop bundles previously transferred by the packing fingers, to form a bale. The packing plate only moves 5 ins (125 mm) rearwards & 3 ins (75 mm) upwards during each stroke: far less than a normal square baler.

As the packing fingers feed further crop bundles into the bale chamber, those already there are forced upwards and rearwards, partly by the incoming crop and partly by the action of the packing plate. Ribs in the baler's throat extend up slightly into the bale chamber and discourage crop from falling back down *(towards the pick-up)* between each stroke of the packing fingers. This helps prevent crop being crushed in the throat by the next compression stroke of the packing plate, the base of which extends down into the upper part of the throat *(Fig.3.1)*. Adjustable 'dog teeth' gripper plates in the front of the bale chamber floor perform a similar role.

During bale formation, the movement of crop upwards & rearwards into the bale chamber is restrained slightly by the tension in three strands of heavy-duty polypropylene twine which are paid out from the twine box over the forming bale, via the needles located below the chamber floor. The front ends of the twine are retained in the knotters. As the bale expands further, two spring-loaded 'roof hooks', which hang down into the bale chamber, engage the bale's upper, rear surface and provide further restraint; to improve the firmness and shape of rear, upper corner of the bale.

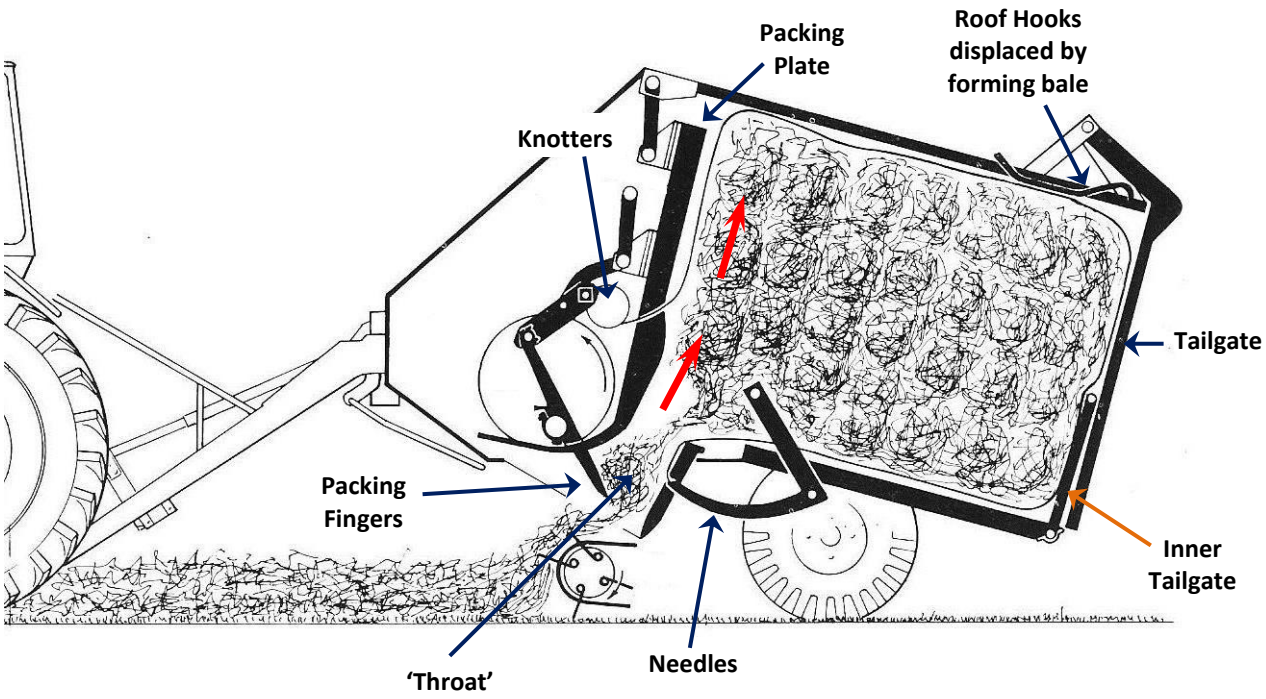


Fig.3.2 Howard Bigbaler (cross-sectional view) – Bale nearing completion

When the chamber is almost full, the rear face of the bale initially contacts the spring-loaded inner tailgate and finally the *(main)* tailgate *(Fig.3.2)*. It is only at this stage that the bale is compressed *(between the packing plate and the tailgate)* and that bale density begins to increase. It is also point when undesirable damage can be caused both to the crop and the baler itself!

A pressure sensor in the tailgate indicates the bale density level to the driver *(**N.B.** This rarely functions on most Bigbalers in use today)*. When desired density has been achieved, the tractor is halted momentarily to allow all crop remaining in the baler's pick-up and throat to be cleared into the bale chamber. The driver can then trigger the knotting sequence by means of a trip cord.

This causes the (three) needles to rise through the baler's throat and deliver the free end of the twine to the knotters, which tie the bale. The tailgate is automatically unlatched at the end of the knotting sequence *(as the needles return)* and baling can recommence. The completed bale is then

pushed out of the chamber by the next bale being formed and it slides down the inner tailgate onto the field surface. The inner tailgate and roof hooks then spring back into the bale chamber, ready to catch the next bale. The top-hinged tailgate closes once it clears the front of the discharged bale and latches shut automatically. Indicators on the front of the baler show whether it has closed and latched properly.

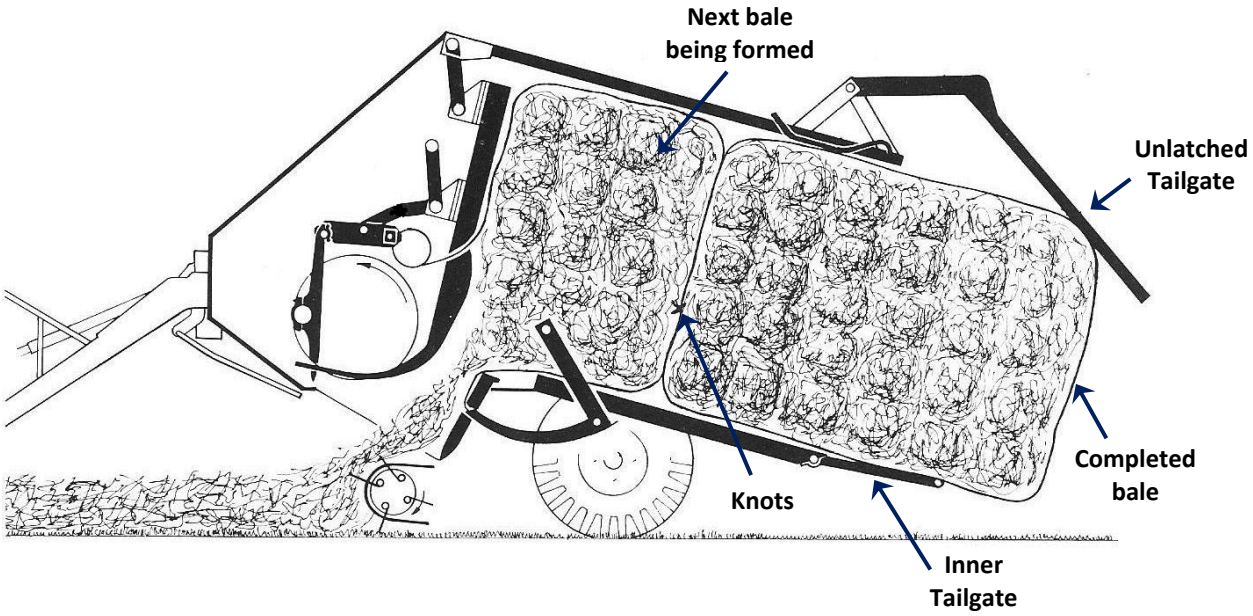


Fig.3.3 Howard Bigbaler (cross-sectional view) – Completed bale being discharged

Why is the Howard Bigbaler so Suitable for Baling Thatching Straw?

The Bigbaler is well-suited for baling unthreshed sheaves because of the following design features:

- **Wide Bale Chamber:** Sheaves of long thatching straw can be packaged cross-wise in the 5 ft (1.5 m) wide bale chamber without bending or excessive rubbing on the chamber sides
- **'Straight-through' Design:** The baler's pick-up reel, 'throat' and bale chamber are all 5 ft (1.5 m) wide. At no point is the crop compressed sideways as it flows through the baler
- **Gentle Crop Handling:** **IF** the baler is operated at the correct p.t.o. speed *(i.e. below 540 rpm)*, the action of the small-diameter pick-up reel, the packing fingers and limited stroke of the packing plate combine to achieve gentle crop handling & packaging.

All of these features help to minimise straw damage and *(unthreshed)* grain loss when baling sheaves of thatching straw.

HOWEVER, the Bigbaler is **NOT IDEAL in its standard form**. In order to minimise crop damage **and** get the best performance, **it is necessary both to modify the machine and use particular operating techniques**. Sections 5, 7 and 8 of this guide explain all.

4 Howard Bigbaler - Product Development

Which Model is It?

When Howard Rotavator started development of the Bigbaler in 1969, they were trying to develop a new machine concept, bring it to the market and ensure its commercial reliability. That's a tall order for any company, let alone one with little or no experience of baler design, setup or troubleshooting. So it's perhaps not surprising that the Bigbaler design went through so many modifications & revisions, particularly during the early years of production?

Howard Bigbalers were produced as either Mk1 machines *(from 1973)* or Mk2 machines *(from 1977).* Approximately 900 examples of each type were built and exported worldwide.

Unfortunately, the reliability of early-Mk1 Bigbalers was so poor that design modifications were introduced every year, finally culminating in the launch of the Mk2 machine in 1977. However, Bigbalers built during the final year of Mk1 production *(1976)* actually incorporated some features found on Mk2 machines, effectively creating a Mk1a variant *(see Table 1).*

Today virtually all surviving Bigbalers have been subject to some degree of *(factory or dealer)* modification or upgrade.

Fig.4.1 Early Mk1 Howard Bigbaler
(courtesy Howard Rotavator Co.)

Mk1 Bigbaler

Produced for the 1973, 1974 & 1975 seasons, the approx. 50 examples sold in 1973 were all subsequently upgraded to '1974' specification to address reliability issues. Gearbox output shafts twisted in service, packing plates failed and the knotters experienced issues.

Unless they have been subsequently modified *(and a number were)*, all Mk1 machines feature a single-section p.t.o. driveshaft, a single tailgate spring and the twine box mounted on the right-hand side of the bale chamber *(see Fig.4.5)*.

Fig.4.2 Later Mk1 Bigbaler
(courtesy Classic Tractor magazine)

Early machines can be identified by oval-shaped side access panels on the flywheel guards *(Fig.4.1).* These were soon replaced on later models by top-hinged 'gull wing'-type doors *(Fig.4.2).*

Mk1a Bigbaler

This was not an 'official' Bigbaler variant. However, machines produced for the 1976 season incorporated the long list of Mk1-model upgrade/design changes, together with the Mk2-model knotter upgrade *(see Table 1).* Consequently, they were not strictly Mk1 or Mk2 machines. Many were subsequently fitted with Howard 'upgrade kits', which included stronger Mk2 packing plates and tailgates, pick-up slip clutches & revised twine fingers, creating a truly unique specification.

Fig.4.3 Mk2 Howard Bigbaler *(courtesy Howard Rotavator Co.)*

Mk2 Bigbaler

Released for the 1977 season, the Mk2 was the final and arguably the most capable Bigbaler variant. It incorporated a whole host of design revisions to overcome the shortfalls of the Mk1 machines. Most were intended to make the baler more reliable and robust, particularly as many users were increasingly trying to push their Bigbalers beyond the original 'low-density baler' design. Many components were redesigned and strengthened including the p.t.o. driveline, main gearbox, knotter and needle drive mechanisms and tailgate *(see Table 1)*.

The twine box was moved to the left-hand side of the bale chamber, twine routing and the twine tensioning system were revised and the needle design changed. Two counterbalance springs were fitted to compensate for the additional weight of the *(strengthened)* tailgate when closing.

Today the majority of Bigbalers used for packaging thatching straw are Mk2 machines.

What Model is my Baler? – Bigbaler Serial Number Plates

The design features of your Bigbaler *(i.e. p.t.o. shaft design, twine box location)* will help identify which model it is *(e.g. Mk1 or Mk2)*, but many earlier balers have been modified over time to include newer features from later models. So, to avoid confusion, the easiest means of Bigbaler identification is to find the machine serial no., which is stamped on a metal plate fixed to the left-hand side of the baler.

Serial Number Plate locations differ between Mk1/1a and Mk2 Bigbalers:

- **Mk1/1a** - Outer face of the bale chamber *(diagonal)* side frame, immediately above the left-hand wheel *(Fig.4.4 (left))*
- **Mk2** - Outer face of the tailgate left-hand hinge support frame, where it joins the bale chamber top frame *(Fig.4.4 (right))*

The Serial Number Plate also has a space for the baler's Model No. **BUT** this was never marked on Mk1/1a machines. However, the model no. of Mk2 Bigbalers was always stamped on the plate *(Fig.4.4 (right)).*

Fig.4.4 Howard Bigbaler serial number plate locations *(highlighted)* and example plates - Mk1/1a *(left)* and Mk2 *(right)*

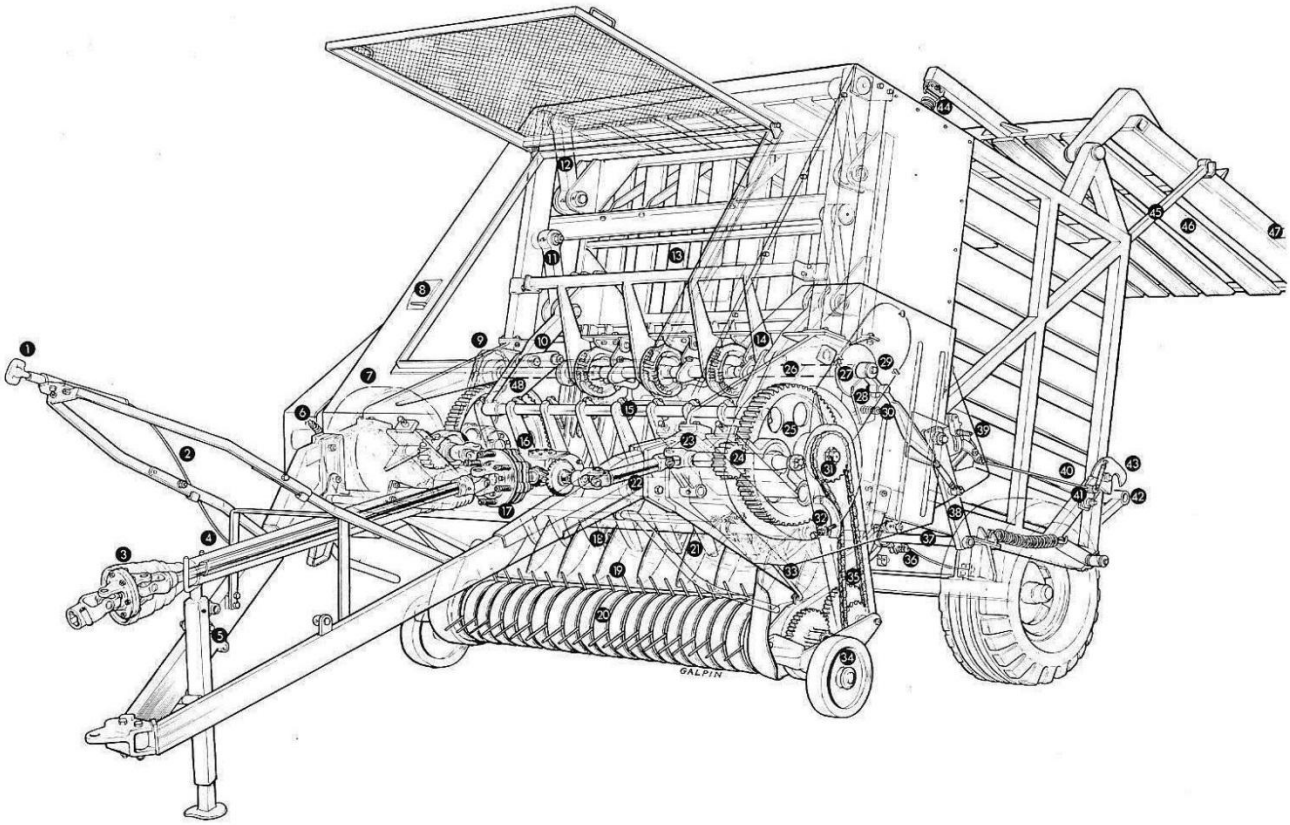
Bigbaler Serial Numbers - Format

- **Mk1/1a balers** - **990A 1*****
- **Mk2 balers** - **990A 2*****

Prefix **Serial No.**

The format of Bigbaler serial numbers is the same for Mk1 and Mk2 models. Both carry a '990A' prefix *(which has no meaning unless you restore David Brown tractors)*, but **the real serial number is the four-digit number** which follows *(see above)*. This number corresponds directly to the point in the production sequence when a particular baler was manufactured. The serial numbers of all Mk1/1a balers begin with a '1' whereas those of Mk2 balers begin with a '2':

- **Mk1 balers** - Serial No. 1001 – 1312 *(approx.)*
- **Mk1a balers** - Serial No. 1313 onwards *(approx.)* but further design changes were introduced at s/n 1414. Production is thought to have ended at approx. s/n 1900
- **Mk2 balers** - Serial No. 2001 onwards. Production is thought to have ended at approx. s/n 2900

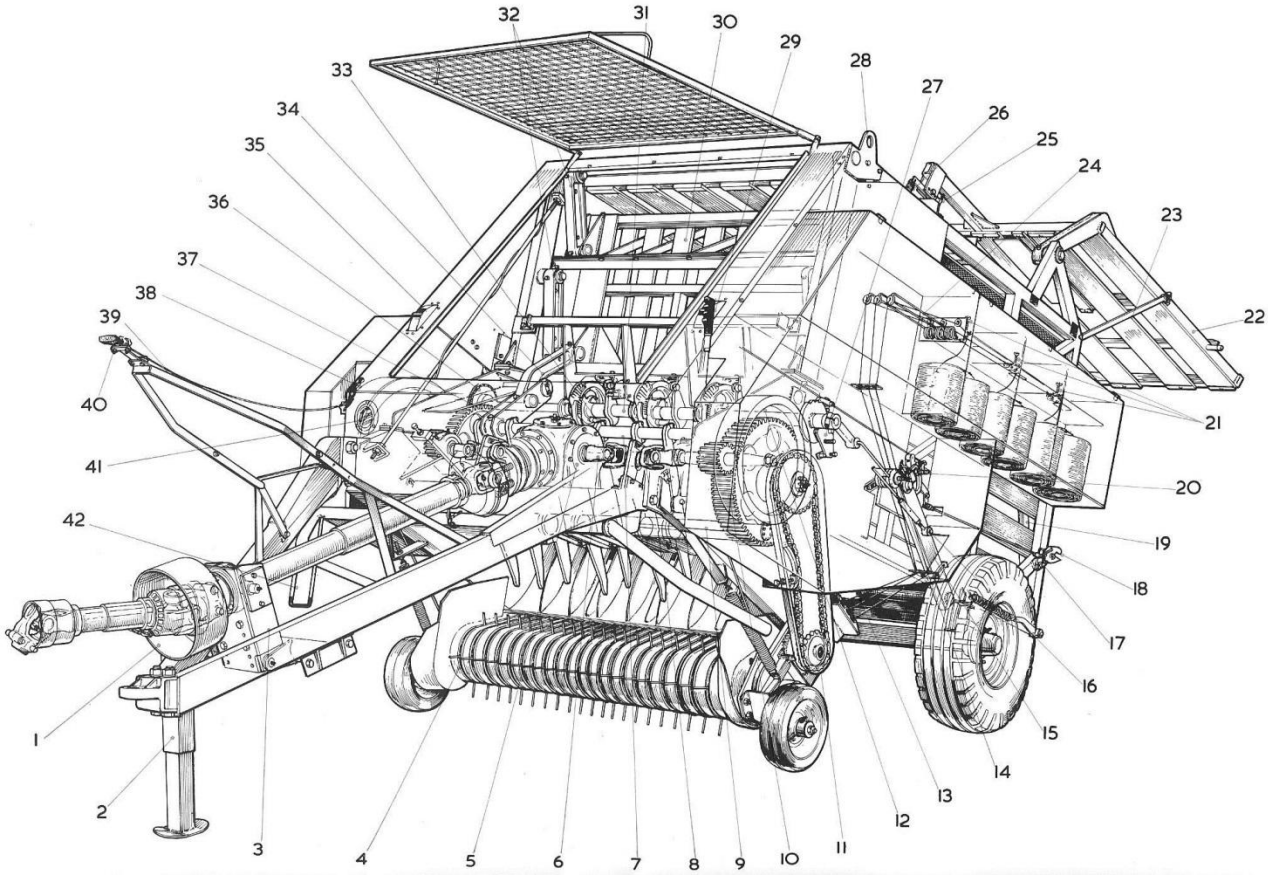


KEY

1. Trip cord grip.
2. Trip cord.
3. Wide angle coupling.
4. Universal joint assembly.
5. Screw jack.
6. Pick up reel lifting rod spring.
7. Flywheel.
8. Tailgate position indicator.
9. Chain drive knotter.
10. Cranked links.
11. Swinging links.
12. Swinging links.
13. Packing plate.
14. Knotter assemblies.
15. Rocker tube.
16. Bevel gearbox.
17. Safety clutch.
18. Packing fingers.
19. Baler throat.
20. Pick up reel.
21. Needles.
22. Packing beam.
23. Jackshaft.
24. Pinion.
25. Spur gears.
26. Knotter shaft.
27. Brake disc.
28. Knotter brake.
29. Knotter crank arms.
30. Coil spring and adjusting bolt.
31. Sprocket, pick up reel drive.
32. Adjustment setscrew and locknut.
33. Pick up reel lifting rod.
34. Pick up reel height control wheels.
35. Chain drive -- pick up reel.
36. Twine tensioner.
37. Needle shaft.
38. Needle arms.
39. Trip plate assemblies.
40. Connecting rod.
41. Tailgate release lever.
42. Inner tailgate.
43. Spring loaded catches.
44. Tailgate spring.
45. Tailgate strut.
46. Tailgate.
47. Tailgate peg.
48. Rocker arms.

Fig.4.5 Mk1 Howard Bigbaler - Main components

(courtesy Howard Rotavator Co.)



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1.	Universal joint assembly.	22.	Tailgate.
2.	Parking jack.	23.	Tailgate support.
3.	Mounting bracket.	24.	Spring arm tensioner.
4.	Pick up reel.	25.	Tailgate spring adjuster.
5.	Bevel gearbox.	26.	Tailgate spring.
6.	Short universal joint.	27.	Knotter brake.
7.	Rocker shaft.	28.	Sling point.
8.	Packing finger.	29.	Pick up reel handle.
9.	Packing tube.	30.	Packing plate.
10.	Gear wheel.	31.	Knotter shaft.
11.	Drive chain.	32.	Swinging links.
12.	Flywheel.	33.	Knotter.
13.	Needle.	34.	Cranked link.
14.	Crank arm.	35.	Tailgate indicator.
15.	Disc twine tensioner.	36.	Knotter drive.
16.	Needle cage.	37.	Rocker arm.
17.	Release lever.	38.	Safety hook.
18.	Tailgate catch.	39.	Trip cord.
19.	Inner gate.	40.	Trip cord grip.
20.	Tailgate opening mechanism.	41.	Pressure guage.
21.	Twine tensioner.	42.	Foot step.

Fig.4.6 Mk2 Howard Bigbaler - Main components

(courtesy Howard Rotavator Co.)

Table 1 Howard Bigbaler – Key design differences between models

Machine Feature	Bigbaler Mk1	Bigbaler Mk1a	Bigbaler Mk2
P.T.O. Driveline & Gearbox	• Single section p.t.o. shaft with wide-angle joint on tractor end • Gearbox with square outer casing	• Single section p.t.o. shaft as per Mk1 • Strengthened Mk1-type gearbox • Two-section p.t.o. shaft with mid-support*(upgrade)*	• Two-section p.t.o. shaft with mid-support bearing • New, uprated gearbox with round outer casing • Failsafe guards fitted to gearbox output shafts
Pick-up Reel	• Full-width, floating, 4-bar, cam-type, tined pick-up reel	• As Mk1, but 'stripper' bands easier to remove • Safety overload clutch *(upgrade kit)*	• Strengthened with mid-mounted support plate • Safety overload clutch fitted • 'Ribbed' stripper bands introduced part-way through production
Packing Fingers	• Nine semi-rotary fingers on a gear-driven shaft	• As per Mk1	• Packing Finger to Knotter Frame clearance increased
Packing Plate	• Strengthened on very early machines	• As per Mk1, but some machines retrofitted with Mk2 Packing Plate	• Revised, strengthened design • Lower section reinforced • Mounting plate design revised
Knotter Drive	• Chain-driven via manually operated trip mechanism • Knotter shaft & needle drive keyed onto *(drive)* shaft(s)	• As per Mk1	• Knotter shaft & needle drive strengthened *(splined instead of keyed)* • Stronger knotter brake pawl • Thicker knotter shearbolt on very late machines
Knotters	• Three uprated 'Rasspe' baler knotters	• Certain knotter components upgraded • Knotter support frame modified to aid Knotter Stack removal	• Knotters as per Mk1a • Twine Finger shape and adjustment modified • Twine Finger rod strengthened
Needles & Twine Supply	• Twine Box on m/c R.H. side • Plate-type twine tensioners on twine box & needle frame • Fabricated steel needles	• As per Mk1, but: • Needle frame twine tensioners mounted lower • Twine no longer passes through plate on underside of needle frame	• Twine route completely revised • Twine Box on m/c L.H. side • Plate-type twine tensioners inside twine box & disc-type tensioners on machine L.H. side • Cast aluminium needles incorporating rollers in each 'eye'
Bale Chamber	-	-	• Gaps between side boards filled-in *(at front of chamber)*
Tailgate	• Inner tailgate top tube non-removable • Single counterbalance spring on main tailgate	• Inner tailgate top tube removable • Tailgate board widths modified	• Tailgate strengthened • Twin counterbalance springs fitted *(single adjustable spring on later models)*

5 Bigbaler Modifications – to Improve Operation in Thatching Straw

Why modify a Bigbaler?

Certain mechanical modifications can be made to a standard Howard Bigbaler to make it much more efficient when baling thatching straw *(in sheaves)*. These modifications will:

- Improve baler performance
- Improve baler reliability
- Reduce straw damage during baling & improve product quality

However, baler modifications are not the whole solution:

- Proper machine preparation before starting work
- Use of the correct in-field operating techniques
- Attention to detail

- are also very important *(see Section 6, 7 and 8)*

SAFETY WARNING

The operation, maintenance and repair of power (p.t.o.) driven agricultural machinery creates risks which need to be managed, so:

PLEASE BE AWARE OF THE RISKS, ASSESS THEM AND TAKE APPROPRIATE STEPS TO MANAGE THEM

Do's and Don'ts

When working on or making any modifications to a Bigbaler **please remember to:**

- **OBTAIN**, read and make sure you understand the baler's Operator's Manual *(see Section 13)*
- **ALWAYS** chock the baler's wheels to prevent it moving
- **NEVER** work under the baler if it is only supported by a jack. Use appropriate axle stands or stout wooden block to support the machine
- If the Tailgate is raised to gain access to the bale chamber, **ALWAYS** support it safely, either with the strut located in the baler's rear frame *(see Figs 4.5 & 4.6)* or with a suitable steel or wooden prop
- **ALWAYS** isolate the baler's power take-off (p.t.o.) shaft from any power supply
- **If** the baler is attached to a tractor, **ALWAYS follow the SAFE STOP procedure:**
  - **Disengage** the tractor power take-off (p.t.o.)
  - **Apply** the parking brake
  - **Stop** the tractor engine

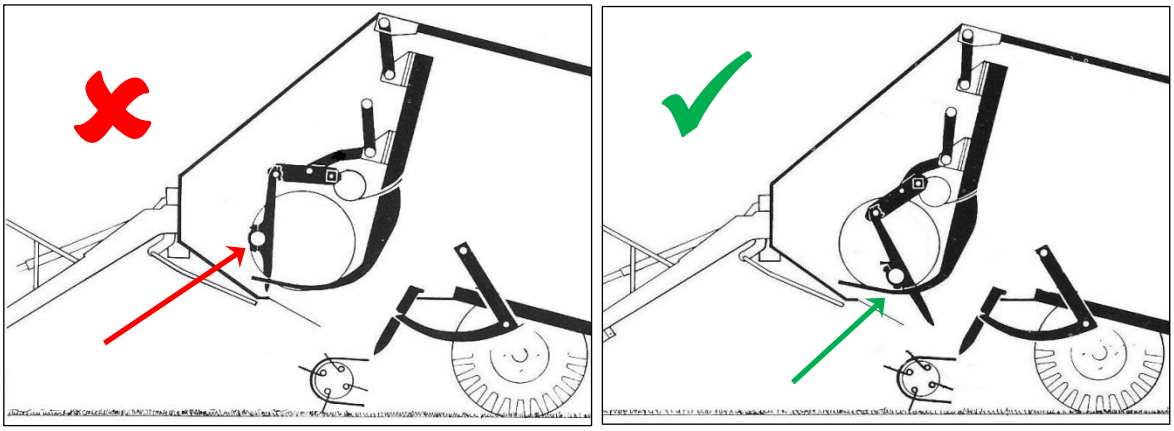


Fig.5.1 Bigbaler Packing Finger locations when the machine is 'at-rest'
- Not at Bottom Dead Centre *(left)* **(UNSAFE)**
- At Bottom Dead Centre *(right)* **(SAFE)**

- **REMEMBER** that the baler's internal mechanism can move by itself due to gravity
- **ALWAYS** ensure the baler's Packing Fingers are in the **'Bottom Dead Centre'** position **and** the Packing Plate is fully forward **BEFORE** climbing onto or into the baler *(Fig.5.1 (right))*
- **If** it is necessary to work on the baler with the packing fingers or packing plate in a different position, the mechanism can be locked by inserting a soft metal bar or a 10 mm diameter bolt between the teeth of the packer finger gears & their drive pinions, **BUT:**

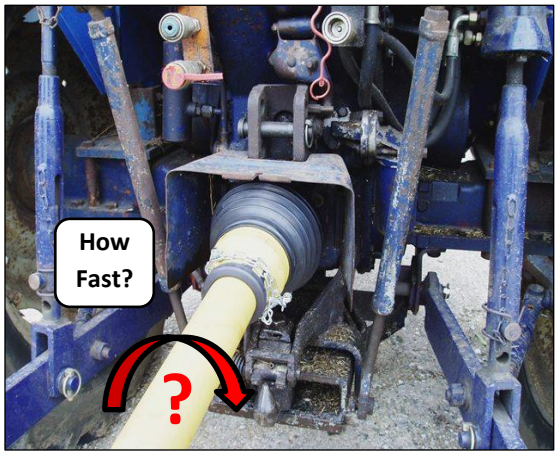
  - **ALWAYS** ensure the bar/bolt is inserted in the correct position:
  - **Above** the drive pinion - If the packing finger tube is towards the front of the baler *(Fig.5.2)* **or:**
  - **Below** the drive pinion - If the packing finger tube is nearest to the packing plate

  - **ALWAYS** remember to **Remove the Bar** before powering-up the baler!

Fig.5.2 Packing finger drive gear & pinion indicating **one** possible location to insert a locking bar/bolt

- **ALWAYS** remove any accumulated combustible material from the baler before grinding, cutting or welding on the machine
- **ALWAYS** ensure that following any modification of the baler:
  - **All** original safety guards are in good condition and are refitted to the machine
  - **If** any new safety risks are introduced by the modification(s), that appropriate additional guarding and/or warnings are installed on the machine.

5.1 Bigbaler Operating (P.T.O.) Speed



You might say that selection of the correct p.t.o. speed is really an 'operating technique' rather than a 'machine modification'. However, the p.t.o. speed at which a Bigbaler is driven influences not only how the machine behaves in this application, but also the effectiveness of a number of the suggested modifications. **So it is very important!**

Bigbalers were originally designed to be operated at *(the standard)* 540 p.t.o. rpm: this produces approx. 65 strokes of the Packing Plate per minute.

However, when baling thatching straw, operating the baler at this speed will cause excessive straw damage and unnecessary grain loss from the *(unthreshed)* sheaves. A certain degree of straw damage can't be avoided during baling, **but** it can be minimised without significantly compromising baler workrate.

These problems can be avoided by operating the baler at a slower p.t.o. speed: 330 – 375 p.t.o. rpm *(approx. ⅔ of 540 rpm)* is a good compromise between reduced crop damage and acceptable workrate. To check if the baler's speed is correct, simply count the number of strokes made by the Packing Plate during 30 seconds. Approx. 20 – 22 strokes per 30 secs *(~40 – 45 stokes/min)* is ideal.

Some users believe that the Bigbaler's knotters will not perform reliably unless the machine is operating close to 540 p.t.o. rpm when the knotters are tripped. In fact, if the knotters, twine fingers and twine tensioners are adjusted & maintained correctly *(see Sections 6.4 & 6.5)*, and their operating areas are kept clear of debris, the baler will tie reliably even at very low p.t.o. speeds

However, if operated at a higher p.t.o. speed, the knotter components and needles will have greater inertia and so are more likely to return to their correct 'at-rest' position following the tying cycle *(see Fig.6.27)*.

So, if you prefer, momentarily increase the baler's speed up to nearer 540 p.t.o. rpm just before tripping the knotters to tie the bale. This can easily be done using the tractor's foot throttle. **BUT remember** to return back to a slower p.t.o. speed before starting to make the next bale.

Tractor P.T.O. Speed - Do's and Don'ts

- **DON'T** operate a Bigbaler at 540 p.t.o. rpm when baling thatching straw
- **DO** use approx. 330 – 375 p.t.o. rpm *(~⅔ of standard p.t.o. speed)*
- **DO** check the baler's speed – Count the number of Packing Plate strokes in 30 secs
  - ~20 – 22 strokes per 30 secs *(~40 - 45 strokes/min)* is ideal
- **DON'T** attempt to use the tractor in '1000 p.t.o. rpm' gear at a reduced engine speed. You will never obtain a slow enough p.t.o. speed to suit the Bigbaler in this application
- **IF YOU PREFER,** increase p.t.o. speed when you're about to trip the knotters / during the tying cycle

5.2 Pick-up Reel – Windguard Installation

The purpose of a windguard is to apply slight pressure onto the top of the crop as it passes over the pick-up reel. This keeps the crop in contact with the pick-up tines as they lift the material from the swath into the baler and improves the speed & effectiveness of crop transfer.

So pick-up windguards are useful things: but unlike most balers, the Bigbaler was never fitted with one. Perhaps it wasn't considered necessary when the baler was designed to pick up wide, rectangular cross-section swaths at quite high forward speeds *(4 – 8 mph)*?

Baler icon graphic However, when baling thatching straw, things are a little different. Instead of collecting loose crop from a swath, the Bigbaler has to pick up pre-packed bundles *(sheaves)* at lower forward speeds. These don't behave like a carpet-type swath, but rather as distinct bundles: so they can be slightly more difficult to get into the machine.

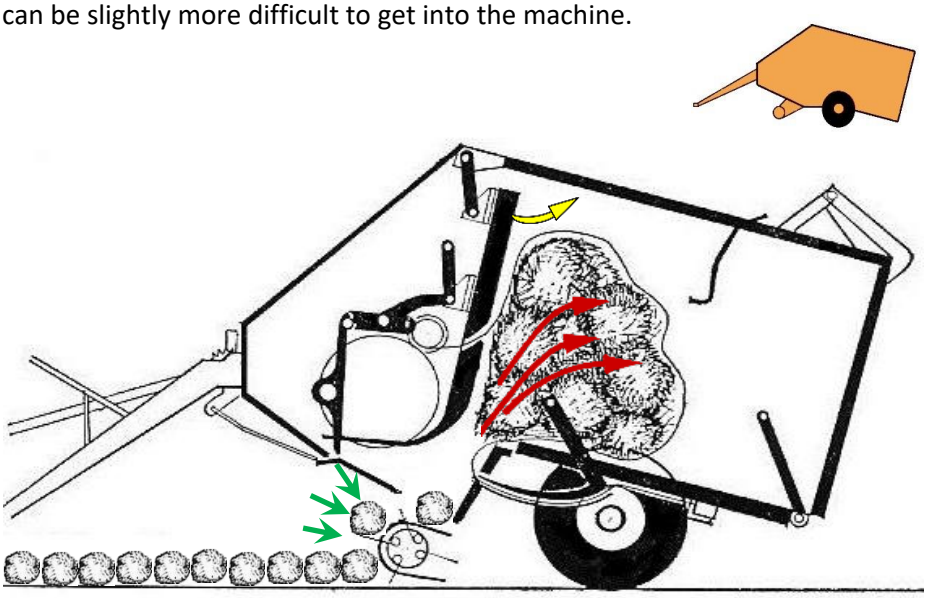


Fig.5.3 Bigbaler packaging sheaves – Green arrows show the required directions of pressure application from the windguard to improve pick-up reel performance

Fortunately, the Bigbaler's pick-up reel is of relatively small diameter and is well-suited to getting under and lifting sheaves which have been arranged laterally *(cross-wise)* in a swath. It isn't even necessary to set the pick-up reel particularly close to the ground. However, the Bigbaler's pick-up reel is quite highly-geared and so, even when the baler is operated at reduced p.t.o. speed *(see Section 5.1)*, there is a tendency for sheaves to be thrown diagonally forward as the pick-up reel attempts to lift them up and into the baler's 'throat'.

To overcome this problem, many Bigbaler users have found it worthwhile to install homemade windguards that apply slight horizontal & diagonal pressure to the crop as it passes up & over the front of the pick-up, from approx. the 9 o'clock to 11 o'clock position *(see Green arrows in Fig.5.3).* ***(Click on the Baler icon or scan the QR code for video of Bigbaler pick-up reel operation).***

The most effective windguard designs incorporate a pivoting tine bar with upward-curved tines *(Fig.5.4).* The tine bar's pivot point is sited relatively low down in front of the pick-up reel, but is set sufficiently high so as not to interfere with the swath as it passes underneath.

As the swath approaches the pick-up, it causes the windguard to pivot upwards so that the lower *(curved)* ends of the tines become parallel with the front-upper *(diagonal)* surface of the pick-up reel.

The crop is then sandwiched between the windguard & the reel and the action of the pick-up tines rapidly transfers it into the baler's throat. If the crop volume increases unexpectedly, the windguard simply pivots up slightly further and allows the excess material to pass through.

Windguard Do's and Don'ts

- **DO** fit a windguard - ideally use a pivoting tine bar fitted with curved tines
  - **IF** the windguard can pivot, **incorporate a travel limit-stop** to prevent excessive upward movement & the tines contacting the underside of the packing plate
- **DON'T** make the windguard heavier / add weight to try and increase pressure on the crop
  - **Attach a *(adjustable?)* spring** to the pivot instead *(like most other balers)*. This will keep a consistent pressure on the crop, prevent windguard bounce & be far better overall
- **DON'T** be tempted to apply *(vertical)* pressure to the swath before it reaches the pick-up reel. There's no real benefit – Just keep diagonal *(rearwards)* pressure on the crop as the pick-up raises it.

Windguard designs vary. Go with what you think is best, **BUT** keep these basic requirements in mind

Fig.5.4 Pivoting windguard on a Bigbaler pick-up reel – Optimum design featuring long, curved tines and a low front pivot point. Pivot should ideally be spring-loaded **and** incorporate a travel limit-stop

5.3 Crop Intake and Compression System

The packing fingers and the packing plate of a Bigbaler are linked - both mechanically and also in the role that they perform. Both components act together to transfer the crop from the pick-up reel, up through the baler's 'throat' and into the bale chamber. So it's likely that modifying one of these elements of the machine may have an impact on the operation of other. With this in mind, let's consider each in turn.

5.3.1 Crop Intake 'Throat' – Modification of Rib Height and Profile

The baler's 'throat' incorporates eight tapered, vertical 'ribs' which protrude forward from the throat's rear wall and extend from just above the pick-up reel, right up into the bale chamber *(Fig.5.5).*

During baler operation, as the packing fingers transfer the crop from the pick-up reel into the bale chamber, their tips pass between the ribs *(Fig.5.6).*

Most thatching straw growers consider that the *(combined)* high profile & narrow leading edge of each rib will damage the straw as it is passed through the baler's 'throat': and there's some truth in this. This is therefore one of the most frequently modified areas on Bigbalers.

Fig.5.5 Unmodified steel ribs inside the Bigbaler's crop intake 'throat' *(viewed from inside the bale chamber)*

However, components are put there for a reason. **The ribs perform two very important functions:**

- **Keep the crop/sheaves forward *(onto the Packing Fingers)*:** The tips of the packing fingers don't pass particularly close to the rear wall of the throat *(Fig.5.6)*, **BUT** the ribs keep the crop forward *(away from the rear wall)* so it remains on the upper surface of the packing fingers and is moved efficiently.

  If the ribs were not present, some crop would tend to drop over the ends of the fingers and be rubbed against the rear wall of the 'throat', resulting in much more abrasion & crop damage

- **Prevent the crop falling back from the Bale Chamber:** The upper front corner of each rib extends up into the bale chamber and acts as a non-return valve, to discourage material from falling back down towards the pick-up between successive strokes of the packing fingers *(Fig.5.6).*

  This is important because the base of the packing plate extends down into the baler's 'throat'. So any material which remains in *(or falls back down into)* the throat will be crushed by the next compression stroke of the packing plate. This will cause damage both to the crop and the packing plate.

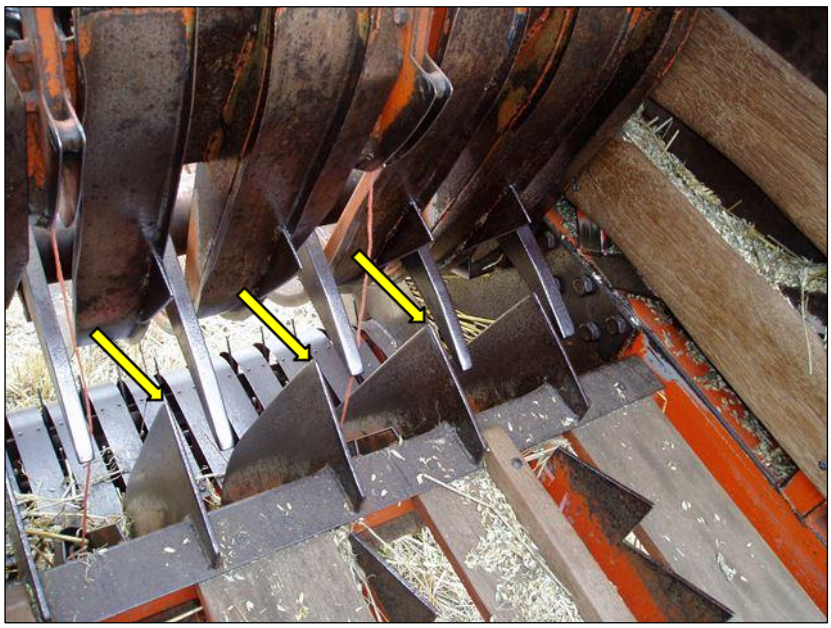


Fig.5.6 The relative positions of the packing fingers and 'throat' ribs at the top of the packing fingers' stroke. The rib front corners *(arrowed)* act as a non-return valve in the crop flow

How Can Crop Damage be Reduced?

There's no doubt that in their standard *(original height)* form, the ribs will cause damage to thatching straw during baling.

Bigbaler users have developed many different rib modifications over the years to reduce crop damage. Some improve matters, but unfortunately some *(although well intentioned)* can actually make matters worse.

A selection of 'good' and the 'not so good' modification are shown in Fig.5.11

Fig.5.7 Perpendicular height of an unmodified 'throat' rib where it enters the bale chamber *(~115 mm)*

The simplest and probably most effective way to reduce crop damage caused by the ribs in the first instance is simply to reduce their *(perpendicular)* height, **BUT** to leave their shape/profile largely unchanged.

At the point where they enter the bale chamber, the standard/unmodified ribs are ~115 mm high *(Fig.5.7).* Simply reduce the rib height at this location by approx. 50% *(to~65 mm)* and then continue to cut down/along the rib, keeping parallel to the original leading edge *(see dotted Red line – Fig.5.8).*

- **Ensure** the rib leading edges remains slightly above the needle protection shrouds *(Fig.5.8)*
- **Don't** 'round-off' the top corners of the ribs where they enter the bale chamber.

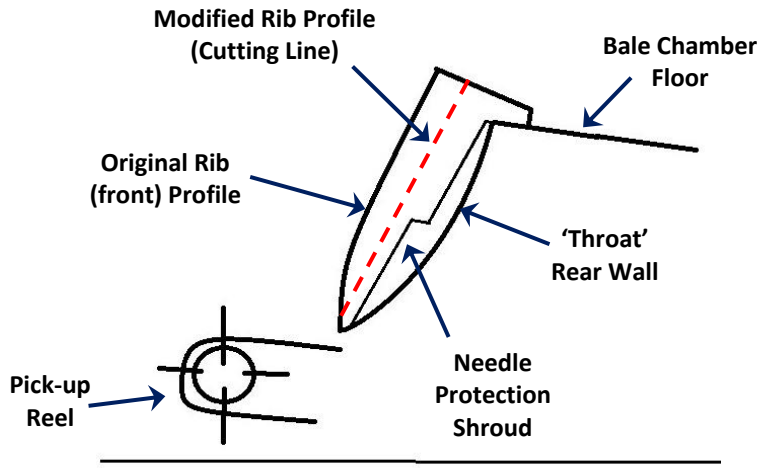


Fig.5.8 Recommended modification to Bigbaler 'throat' rib height and profile *(dotted Red line)* to reduce crop damage during baling

Fig.5.9 Modifying the 'throat' rib height and profile of a Mk1a Bigbaler

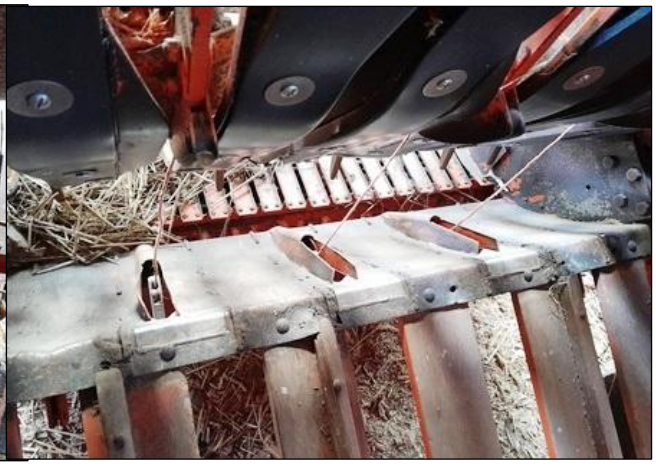
Use of a wooden template to guide the *(plasma)* cutting torch *(left)* and the resulting rib offcuts *(right)*

Fig.5.10 The finished job - Modified Bigbaler 'throat' ribs: **Note** the reduction in rib height but retention of the original rib profile *(above & right)*

Throat Rib Height & Profile - Do's and Don'ts

- **DO** reduce the height of the Ribs, **BUT** not by too much:
  - The Rib leading edges **must** be higher than the Needle Shrouds, to protect the needle tips
  - Making the Ribs too small / shallow will result in poorer crop flow through the 'Throat'
- **DON'T** remove all the Ribs from the Throat. This will actually increase crop damage and increase the risk of Needle damage
- **DON'T** 'round-off' the top corners of the Ribs where they enter the bale chamber. Keep them 'square' to maintain their 'non-return valve' function
- **CONSIDER** attaching steel bars and/or alkathene water pipe to the Rib leading edges. It will remove the narrow leading edge and probably reduce friction, aid crop flow & reduce straw damage
- **DON'T** be tempted to remove any of the packing fingers. It will reduce the efficiency of crop transfer through the Throat and actually provide more opportunity for crop damage.

Rib height reduced too much & upper corners rounded-off - **(Not Ideal)**



Ribs totally removed – Needle shrouds exposed - **(Very Poor)**

Ribs cut down towards bale chamber & upper corners rounded-off, but lower ends untouched - **(Not Ideal)**

Steel bars on rib leading edges but overall height too low - **(Could be Better)**

Rib height reduced appropriately & upper corner profile maintained - **(Very Good)**

Rib height reduced, upper corner profile maintained & leading edges lined with plastic water pipe - **(Excellent)**

Fig.5.11 Example modifications to Bigbaler 'Throat' Ribs – the 'Good' and the 'Not So Good'

5.3.2 Packing Plate

Compared with the crop intake throat, there's little scope for beneficial modification of the Bigbaler's packing plate; whether you wish to reduce crop damage or improve throughput.

However, there is a danger of making well-intentioned but undesirable modifications which will actually make things worse!

The packing plate has a row of triangular 'crop lifter' plates attached to its lower, rear face, just above the level of the bale chamber floor *(Fig.5.12).*

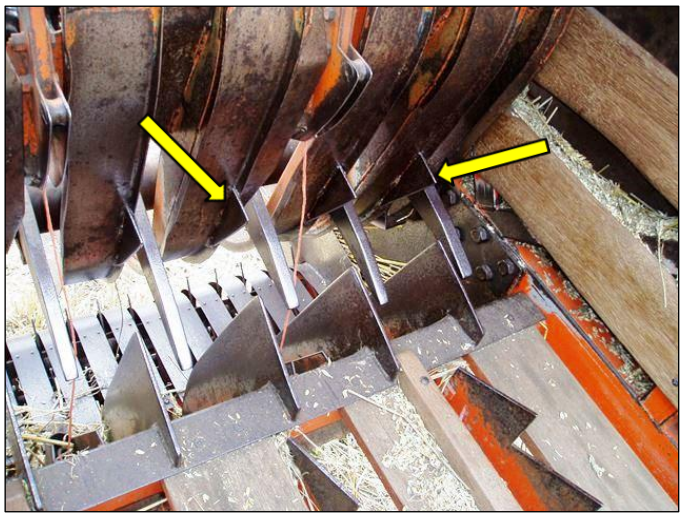
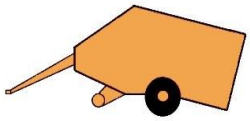


Fig.5.12 Packing plate triangular 'crop lifters' *(arrowed)*

When baling, the packing fingers, throat ribs and 'crop lifter' plates each play an important, *(sequential)* role in moving the crop into the bale chamber ***(click on Baler icon or scan QR code for video)***.

1) **Packing Fingers:** Move the crop through the throat & raise it just past the ends of the throat ribs & just above the *(packing plate)* crop lifters



2) **'Throat' Ribs *(upper ends)*:** Discourage crop from falling back down into the throat when the packing fingers retract for their next stroke

3) **Packing Plate 'Crop Lifters':** Because the packing plate moves **in a rearwards & upwards arc**, the 'crop lifter' plates then raise the crop up into the bale chamber, up & over the face of the forming bale.

Some Bigbaler users remove the 'crop lifter' plates for fear of the damage they may do to the passing crop. **DON'T be tempted to do this**.

The crop lifters may look aggressive, **BUT they play a vital role** in moving crop up the front face of the bale *(see Figs 3.2 & 8.4)*. Their removal will slow-down crop flow in the front of the bale chamber & cause each incoming sheaf to receive multiple impacts from the packing plate. This will cause more straw damage than if the 'crop lifter' plates had remained.

Some Bigbaler users line the rear face of the packing plate with resilient material *(e.g. rubber strip).* This won't do any harm but, in reality, the packing plate is not a major source of crop damage **IF** the correct baler operating technique is used *(see Sections 8.1 & 8.2)*.

Packing Plate - Do's and Don'ts

- **DON'T** remove the triangular 'crop lifter' plates – It will increase crop damage
- **For Least Straw Damage:** Try to get each new sheaf moved-on smartly from the 'throat' and form the bale as quickly as possible. Ensure that each new piece of incoming crop receives the minimum number of impacts from the Packing Plate

5.4 Bale Chamber

There are three potentially worthwhile modifications which can be made to the Bigbaler's bale chamber to reduce crop damage when baling thatching straw. However, what might seem like an obvious move may not always be such a good idea.

5.4.1 (Floor-mounted) Dog Teeth

Two pairs of steel 'dog teeth' plates protrude through the bale chamber floor, immediately behind the 'throat' *(Fig.5.13).* They have a series of alternative mounting holes, so their protrusion into the chamber can be adjusted to suit the crop.

The dog teeth play quite an important role. As the packing plate moves the incoming crop up into & towards the rear of the bale chamber *(see Fig.5.3)*, the dog teeth discourage the bale's lower-front face from slipping forwards and receiving repeated impacts from the packing plate. They act as another 'non-return' valve.

Fig.5.13 Floor-mounted 'dog teeth plates' *(arrowed)*

So, in actual fact, **the dog teeth help to reduce crop damage rather than increase it.**

For fear of the crop damage they may cause, most thatching straw growers remove the dog teeth plates completely from their machines. Others reduce the profile of the 'teeth'. **Unfortunately, dog tooth removal is not a good idea** and it's potentially counter-productive because:

- Stopping new crop from slipping forwards in the bale chamber will actually reduce crop damage
- When the bale chamber first begins to fill, new material tends to ride up & over that which is already present *(see Figs 3.1 & 5.3).* As the bale forms, new material then rides up the front face of the bale *(see Figs 3.2 & 8.4)*. So only the base of the bale contacts the dog teeth & this will suffer very little damage as it passes over them, **as long as** they are properly adjusted.

Dog Teeth - Do's and Don'ts

- **DON'T** remove or cut-down the 'dog teeth' plates – They actually help to reduce crop damage
- **DO** ensure they are adjusted properly – Lower the front end relative to the rear to reduce their effect
- **DON'T** be tempted to drill extra holes and lower the plates yet further – There's a danger the needle frame will hit them
- **KEEP** the wooden floor runners in good condition. If really concerned about crop damage, fit slightly thicker/deeper runners rather than attempting to lower the dog teeth plates too far.

5.4.2 Roof Hooks

In standard form the Bigbaler incorporates a pair of spring-loaded 'roof hooks'. These hang down into the rear of the bale chamber from pivot points above the chamber roof *(Fig.5.14)*.

Their purpose is to engage with the rear, upper part of the bale as it forms *(see Figs 3.1 & 5.3)* and provide some resistance to the incoming crop, to improve the shape & density of the rear, top corner of the bale – which typically is rather soft.

As the bale continues to form, the roof hooks rotate until *(when the chamber is almost full)* they no longer contact the bale *(see Figs 3.2 & 8.4)*.

There's no doubt that the roof hooks have quite an aggressive profile and so would cause damage to the bale's outer rear surface when baling thatching straw.

Consequently, virtually all thatching straw growers either tie-up the roof hooks so that they don't contact the forming bale *(Fig.5.15)* or remove them completely.

A convenient way to prevent the roof hooks having any effect is simply to place a length of broom handle between the hook ends and the bale chamber's upper framework *(Fig.5.16)*.

Roof Hooks - Do's and Don'ts

- **DO** remove or lift-up the Roof Hooks – Otherwise they will damage the crop
- **Bale Shape will suffer** *(rear, top corner)* but this is a trade-off which can't really be avoided.

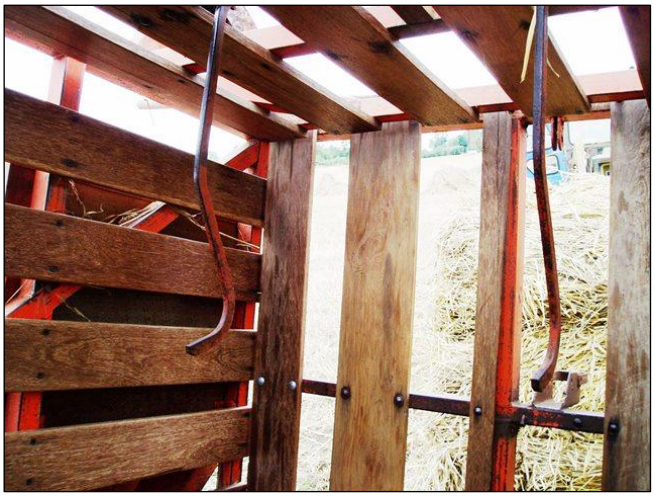


Fig.5.14 'Roof Hooks' in rear of bale chamber

Fig.5.15 Roof Hooks tied-up so as not to contact bale

Fig.5.16 Roof Hooks disengaged by use of a broom handle *(**N.B.** Broom Head is optional)*

5.4.3 In-Fill Gaps in Bale Chamber Sides

The Bigbaler's bale chamber is constructed of a steel framework lined with hardwood boards/slats, each spaced approx. one ½ board width apart.

This probably suited the baler's original application and, as far as the bale chamber floor, roof and tailgate are concerned, this arrangement works well for baling thatching straw too.

However, the board / slat arrangement in the bale chamber sides is perhaps less than ideal, particularly at the front of the chamber.

As crop enters the bale chamber from the throat, it rises up and over the material already present in the chamber *(see Fig.5.3).* The ends of the sheaves inevitably rub against the chamber sides, **BUT** in the front section of the chamber the crop passes vertically & diagonally across the side boards & the gaps between them. This can cause straw damage & encourage grain loss from the unthreshed ears.

Once the crop has passed into the forming bale, it then moves along in line with the boards / gaps and therefore suffers no real further damage: **but unfortunately, the damage has already been done.**

The degree to which the crop rubs against the bale chamber sides is evident by the degree of wear suffered by the side *(mounted)* boards in the front, lower corners of the chamber. The presence of gaps between the boards makes matters far worse.

The bale chamber sides of all Mk1 and early-Mk2 Bigbalers featured gaps between the boards along their entire length *(Fig.5.17).*

On later Mk2 balers these gaps were in-filled in the critical 'front of chamber' area, **BUT** for some reason, this didn't include the important gap at the very bottom of the chamber sides *(Fig.5.18).*

Fig.5.17 Spaced wooden slats on bale chamber sides – Mk1 & early-Mk2 Bigbalers

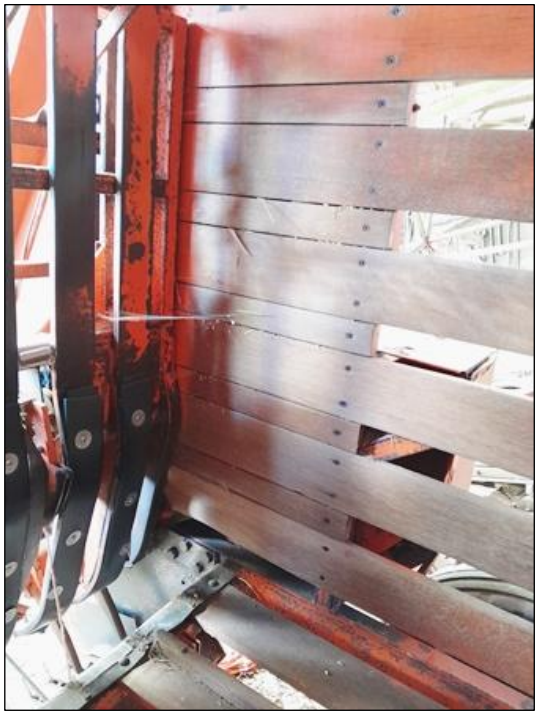


Fig.5.18 Gaps between bale chamber side boards in-filled *(as standard)* – later-Mk2 Bigbaler

In order to minimise crop damage, some thatching straw growers in-fill the gaps between the boards along the entire length of the bale chamber sides, irrespective of whether or not the front section had already been in-filled at the time of manufacture *(see Fig.5.19).*

This can do no harm, **BUT the front & front-lower areas of the bale chamber sides are the most important to address** in order to minimise crop damage**.**

Fig.5.19 Gaps between bale chamber sides in-filled along entire length of chamber:
- Mk1 Bigbaler *(left)* and later-Mk2 Bigbaler *(right)*

Bale Chamber Sides - Do's and Don'ts

- **DO** fill-in the gaps between the boards in the bale chamber sides – **Particularly at the front & bottom-front of the chamber**. It will reduce crop damage & grain loss
- **Consider** filling in the gaps along the entire length of the bale chamber sides; but it won't deliver so much more benefit.

5.5 Tailgate

Structural Integrity

After each bale is discharged, the Bigbaler's tailgate closes with a considerable 'bang'. The tailgate spring is fitted specifically to counterbalance the mass of the closing tailgate and so attempt to cushion its impact on the rear of the bale chamber.

Mk2 Bigbalers were fitted with strengthened tailgates, but the additional cross-members made the unit much heavier *(Fig.5.20)*. To compensate for the additional weight, Mk2 balers were fitted with a second tailgate spring, but unfortunately this still wasn't enough.

Therefore, as a consequence of additional *(closing)* impact forces, the tailgates of most Mk2 Bigbalers have suffered stress cracking in-service and have required repair / reinforcement. The normal location for this repair being the top corner of the tailgate frame *(Fig.5.20 – highlighted).*

By comparison, very few examples of the *(lighter)* Mk1 Bigbaler tailgates seem to have required such repairs.

Fig.5.20 Stronger/heavier Mk2 Bigbaler tailgate featuring two counterbalance springs. In-service reinforcement of tailgate frame *(highlighted)*

Tailgate Springs

Most Mk2 Bigbalers were fitted with twin tailgate counterbalance springs, but *(stronger/heavier)* Mk2 tailgates were also retro-fitted to certain Mk1 balers in-service. In these instances, an additional counterbalance spring should also have been installed, but this didn't always happen; condemning the tailgate & the rear end of the baler to almost certain structural damage during use.

The tailgates of later Mk2 Bigbalers were fitted with a revised counterbalance spring arrangement. The twin springs were replaced with a single, stronger spring *(**N.B.** Not the same as a Mk1 tailgate spring – which is weaker!)*.

This was attached to a revised mounting post which permitted both the spring's tension & its operating height *(mechanical advantage)* to be adjusted *(Fig.5.21).*

Whilst the adjustable tailgate spring is a helpful modification, it is questionable whether even this provides sufficient cushioning effect for the *(heavier)* Mk2 Bigbaler tailgate.

Some users of earlier *(double-spring)* Mk2 Bigbalers have attempted to solve this problem by extending the height of the tailgate spring post by ~70 mm *(Fig.5.22).* This further increases the mechanical advantage of the tailgate spring(s) and the cushioning effect they produce.

The only possible drawback of this modification is a possible reluctance of the tailgate to close properly when working 'uphill' on steep fields: behaviour which the operator should be aware of & closely monitor.

Fig.5.21 Adjustable *(single)* tailgate spring as fitted to later Mk2 Bigbalers

Fig.5.22 Mk2 Bigbaler tailgate spring mounting post extended to increase the mechanical advantage of the springs

Hydraulic Bale Density Indicator System

This simple system indicates the density of the bale in the final stages of bale formation and so tells the operator when to stop packing material into the baler and to trip the knotters. It does so by measuring the level of force which the forming bale exerts on the baler tailgate.

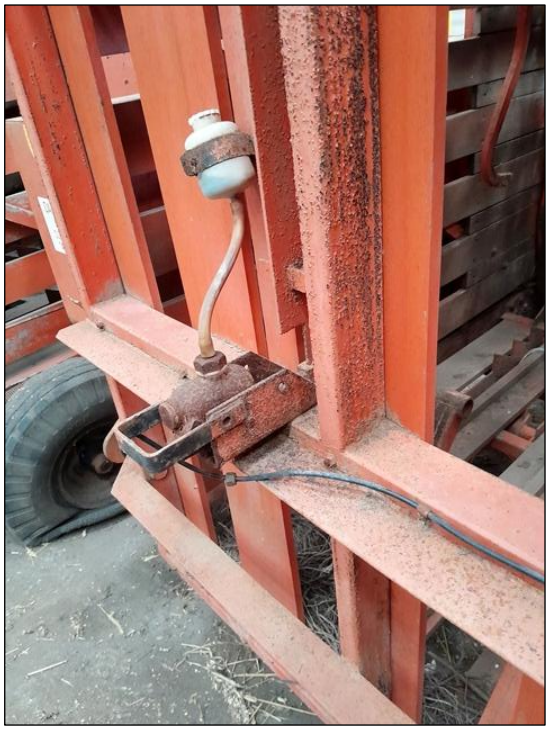


Fig.5.23 Bale density *(pressure)* sensor mounted on Bigbaler tailgate

Fig.5.24 Bigbaler bale density pressure gauge

A top-hinged steel plate, mounted inside the tailgate, acts on an externally mounted *(car)* hydraulic brake master cylinder *(Fig.5.23)*. This is connected to a hydraulic pressure gauge *(Fig.5.24),* mounted on the baler's front panel and visible from the tractor seat.

As bale density increases during the final stages of bale formation, so too does the force exerted on the tailgate & the sensing plate, which in turn causes the hydraulic pressure displayed by the gauge to increase. Howards advised that, when baling hay or straw, the bale would be nearing completion once the gauge reached the *(green)* 400-600 psi range, and the operator should consider halting the tractor and tripping the knotters. However, it was noted that this pressure range would vary for different crops. **The appropriate pressure *(gauge)* range for baling thatching straw is not known.**

The bale density indicator system is rarely found in working order on most Bigbalers used for baling thatching straw today. Instead, most operators appear to prefer to assess bale density by monitoring the baler's *(driveline)* loading level / the tractor's engine load.

However, whilst this approach is usually adequate when using a tractor of moderate power *(see Section 7.1)*, if using a larger and/or a more modern tractor with an enclosed cab, **the bale density indicator system could be of very real value**, enabling the operator to produce more consistent bales and, importantly, to avoid inadvertent baler overloading. In most cases the density indicator system could be recommissioned with relative ease *(see Table 4)*.

5.6 Baler (P.T.O.) Driveline

The Bigbaler's p.t.o. driveline runs directly from the tractor, through a friction-type slip clutch to a centrally-mounted gearbox located above the pick-up reel. Drive then passes out through two short, universally jointed halfshafts to the spur gears on each side of the machine *(see Figs 4.5, 4.6 & 5.26).* The driveline was modified & strengthened during Bigbaler production, to improve reliability and increase power capacity: most changes being introduced with the Mk2 Bigbaler *(see Table 1)*. The key differences are:

- **Mk1 machines**:
  - Long, single-section p.t.o. shaft *(originally)* fitted with a wide-angle universal joint on the tractor end *(Fig. 5.25 (left))*
  - Gearbox with square outer casing *(Fig.5.26 (left))* - strengthened for Mk1a balers. Gearbox input shaft approx. horizontal
  - Longer, but weaker gearbox output *(half)* shafts. No failsafe guards fitted
- **Mk2 machines**:
  - Two-section p.t.o. shaft supported by a mid-support bearing mounted on a *(fore-aft)* pivoting pedestal attached to the baler drawbar *(Fig. 5.25 (right))*
  - Uprated gearbox with circular outer casing *(Fig. 5.26 (right))*. Gearbox input shaft angled-down to be in-line with p.t.o. shaft.
  - Failsafe guards fitted to gearbox output *(half)* shafts to restrain driveshafts & minimise consequential damage in the event of a driveline failure *(Fig.5.26 (right))*

The single-section p.t.o. shafts fitted to Mk1 balers suffered from vibration & consequent wear in service. Over the years many users have renewed these shafts ***(which is Good)***, but have replaced them with 'standard' p.t.o. shafts with a non-wide angle universal joint at the tractor end ***(which is Bad)***. This is likely to cause even more driveline vibration and **is not recommended.**

In comparison, the two-section p.t.o. shaft suffers from much less vibration and wear in-service and is considered to be superior. It also permits greater tractor-baler manoeuvrability when in work, by enabling the combination to follow a curved path without excessive p.t.o. vibration.

Following introduction of the Mk2 Bigbaler, Howard released a retrofit 2-part p.t.o. driveline kit to enable Mk1 machines to be converted to a two-section p.t.o. shaft arrangement *(see Fig.5.27 (left) & Section 13).* This was similar but subtly different to the Mk2 p.t.o. shaft arrangement *(see Fig.6.1)*. The shaft middle bearing support pedestal was rigidly mounted to the drawbar, rather than being free to pivot. It delivers much the same benefits, but the initial setup of the mid-support pedestal is slightly different *(see Section 6.1)*.

Baler Driveline - Do's and Don'ts

In additional to recommended lubrication & maintenance:

- **ALWAYS** ensure that the p.t.o. shaft(s) are properly guarded. This is both a sensible thing to do **and also** is a legal requirement
- **ALWAYS** set the p.t.o. support pedestal *(if fitted)* to the correct height for the height of the tractor's p.t.o. shaft and drawbar *(see Section 6.1 & Table 2)*

Baler Driveline - Do's and Don'ts *(continued)*

- **ALWAYS** ensure that the baler's p.t.o. slip clutch is not stuck and will slip on overload **before** the start of each season *(see Section 6.1)*. Otherwise severe damage can occur
- **ALWAYS** disengage the tractor p.t.o. **before** turning. If the baler has a *(Mk1-type)* single-section shaft, try to only drive in a straight(ish) line when baling
- **DON'T** replace the wide-angle joint on the tractor-end of a single-section Bigbaler p.t.o. shaft with a 'standard' universal joint. It may be cheaper, but it will increase vibration & wear. Instead, if you want to improve things:
  - **CONSIDER** fitting a *(Mk2 or upgraded Mk1)* two-section p.t.o. shaft to Mk1 balers. It will reduce driveline vibration & wear. If fitting a Mk2-type *(pivoting support pedestal)* shaft, consider fitting a Mk2-type gearbox & half shafts at the same time. It will be better overall
  - **CONSIDER** fitting failsafe guards/restraints to the gearbox output *(half)* shafts, if not present *(see Fig.5.28)*. They are simple to make & install and could prevent a lot of expensive & difficult-to-repair damage if a driveline component fails.

Fig.5.25 Bigbaler p.t.o. drivelines: Mk1 Bigbaler single-section shaft with wide-angle universal joint *(left)* and Mk2 Bigbaler two-section shaft with pivoting mid-support *(bearing)* pedestal *(right)*

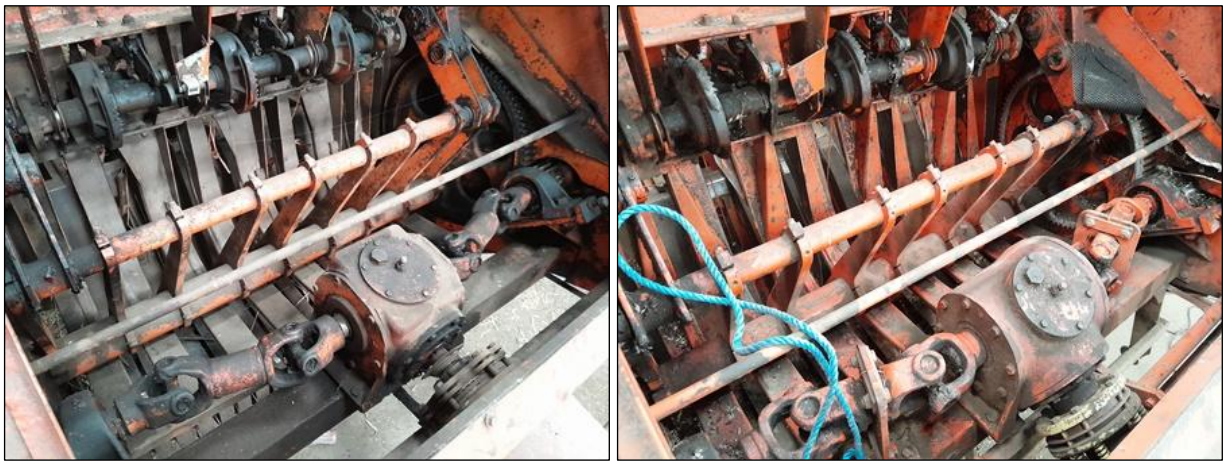


Fig.5.26 Bigbaler gearboxes and output (half) shafts: Mk1 *(left)* and Mk2 Bigbaler *(right)*.
Note failsafe guards fitted around Mk2 baler halfshafts

(courtesy Stags)

Fig.5.27 Bigbaler two-section p.t.o. shafts with mid-support bearing & pedestal:
- Fixed pedestal type *(retrofit)* on Mk1 baler *(left)* - ***(N.B.** Front p.t.o. shaft section not fitted)*
- Pivoting pedestal type on Mk2 Bigbaler *(right)*

Fig.5.28 Failsafe guard retrofitted to Mk1 Bigbaler gearbox output (half) shaft

6 Bigbaler - Pre-Season Preparation and Setup

Introduction

This section of the Guide highlights key areas of the Bigbaler to check and adjust/setup before putting it to work each year. These suggestions are intended to compliment the information provided in the Bigbaler Operator Instruction Manual and **not** be a substitute for it. **Please always obtain and read the Instruction Manual for your particular baler** *(see Section 13 for download details).*

Always follow the baler lubrication recommendations given in the Operator's Manual.

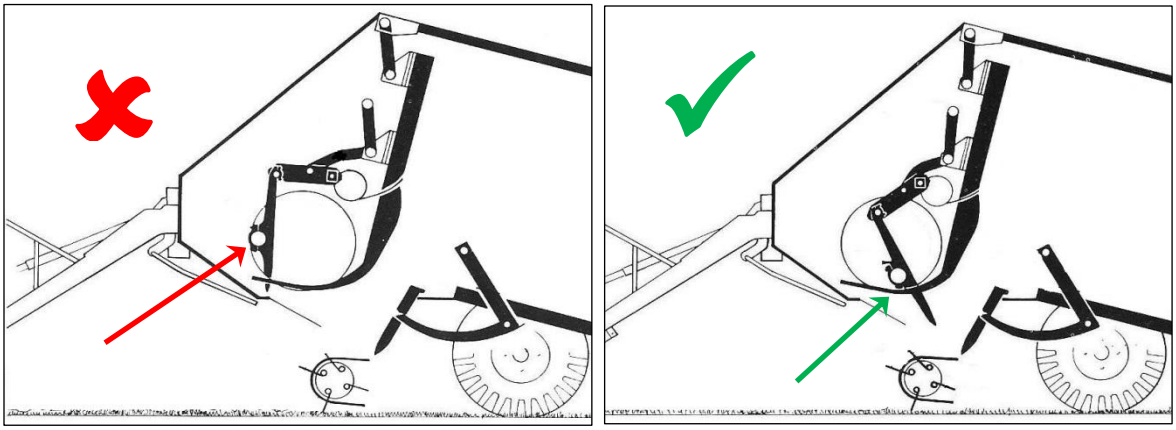
Although it looks nothing like a conventional *(small, square)* baler, many of the Bigbaler's components and mechanisms operate in a similar way to those of a conventional baler. Consequently, many aspects of Bigbaler pre-season setup should be familiar to those who have worked on such machines.

SAFETY WARNING

BEFORE DOING ANY WORK ON A BIGBALER, PLEASE READ THE SAFETY WARNINGS AT THE BEGINNING OF SECTION 5

- AND PARTICULARLY:

- **ALWAYS** isolate the baler's power take-off (p.t.o.) shaft from any power supply
- **If** the baler is attached to a tractor, **ALWAYS follow the SAFE STOP procedure:**
  - **Disengage** the tractor power take-off (p.t.o.)
  - **Apply** the parking brake
  - **Stop** the tractor engine
- **REMEMBER** that the baler's internal mechanism can move by itself due to gravity. Take steps to lock it if necessary, to prevent movement *(see Section 5)*
- **ALWAYS** ensure the baler's Packing Fingers are in the *(lowest)* **'Bottom Dead Centre'** position **and** the Packing Plate is fully forward **BEFORE** climbing onto or into the baler *(see below)*



(UNSAFE) **(SAFE)**

6.1 Baler (P.T.O.) Driveline

Tractor Drawbar and P.T.O.

- **ALWAYS** tow the Bigbaler with a clevis drawbar – **DON'T** be tempted to convert the baler drawbar and use a pickup hook / hitch ring coupling, because the towing point will be incorrect
- **Adjust** the tractor's drawbar so the hitch point is ~14 inches (35 cm) behind the end of the P.T.O. stub shaft *(Fig.6.1) – (usually the drawbar's 'extended' position)*. This is important in order to minimise p.t.o. shaft vibration, particularly with the two-section types *(see Fig.5.27).*
- **TRY** to adjust the drawbar tongue to be ~15 inches (38 cm) above ground. In practice this may not always be possible, as the tractors used today may be larger than those of the 1970-80s
- **Ensure** the telescopic section(s) of the p.t.o. shaft don't 'bottom-out' when turning sharply.

Baler P.T.O. Driveline

- **Ensure** the p.t.o. / gearbox input slip clutch has not seized/stuck over-winter
  - Slacken off the bolts which secure the clutch springs **(N.B. Note the spring length beforehand!** – Should be: Mk1/1a = 2" *(51 mm)* or Mk2 = 1$\frac{1}{16}$" *(27 mm)*
  - Momentarily engage (p.t.o.) drive to the baler and **ensure the slip clutch slips**
  - Retighten the spring securing bolts to achieve the spring length recommended in the Operator's Manual. ***(N.B. Spring length is different for Mk1 and Mk2 baler slip clutches)***
  - **If** the slip clutch becomes excessively hot when in use *(hotter than gearbox)*, **either** tighten the spring securing bolts slightly **or** dismantle the clutch & check condition of the friction plates.
- **Ensure** that the p.t.o. overrun clutch operates freely and lubricate if recommended
- **Ensure** that all guards are in position, are in good condition and are adequately secured
- Lubricate all driveline components as per the recommendations of the Operator's Manual

P.T.O. Mid-Support Bearing Pedestal

If a two-section p.t.o. shaft is fitted *(all Mk2 and certain (modified) Mk1 balers)*, it is important to adjust the height of mid-support pedestal correctly, to minimise driveline vibration. The shaft designs & the possible height settings differ between the Mk1 and Mk2 balers *(see Figs 5.27 & 6.1 and Table 2).*

- **Mk2 Bigbaler** *(pivoting support pedestal)*: **Three height settings** – Lower, Middle, Upper
- **Mk1 modified** *(fixed support pedestal)*: **Four height settings** – Lower, Middle, Upper, Upper + rearward tilt

Support pedestal height adjustment information is given in the Operator's Manual, but it's perhaps not so easy to interpret. All you need to do is:

- Measure the distance *(height)* from the tractor's drawbar to the centre of the *(tractor)* p.t.o. stub shaft *(Fig.6.1)*
- *(For your baler model)* select the tractor's p.t.o. height in Table 2, find the corresponding support pedestal height setting and adjust the pedestal.

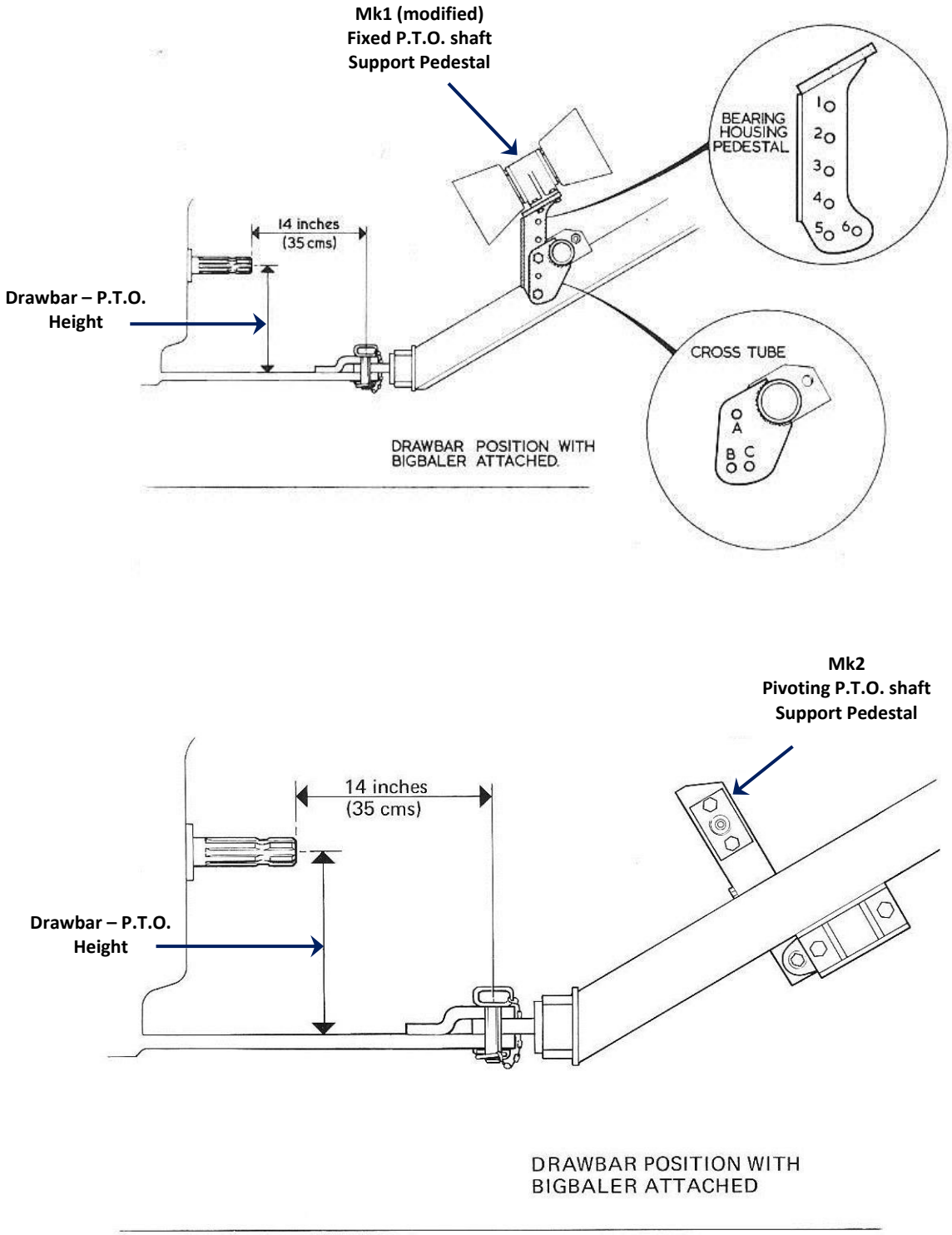


Fig.6.1 Correct Bigbaler attachment to the tractor and height adjustment of *(two-section)* P.T.O. shaft mid-support bearing pedestals *(see also Table 2)*

- Mk1 baler *(retrofit)* fixed pedestal *(top)* and Mk2 baler pivoting pedestal *(bottom)*

(courtesy Howard Rotavator Co.)

Table 2 Howard Bigbaler – Two-section p.t.o. shafts – Mid-support pedestal height settings

Mk1 Bigbaler Fixed mid-support Pedestal		**Mk2 Bigbaler Pivoting mid-support pedestal**	
P.T.O. Height above Tractor Drawbar	**Pedestal Height Setting**	**P.T.O. Height above Tractor Drawbar**	**Pedestal Height Setting**
Up to 9 ins (23 cm)	Lower	Up to 9½ ins (24 cm)	Lower
9 – 11 ins (23 - 28 cm)	Middle	9½ – 11½ ins (24 - 29 cm)	Middle
11 – 13 ins (28 - 33 cm)	Upper	More than 11½ ins (29 cm)	Upper
More than 13 ins (33 cm)	Upper + Rearward tilt	n/a	

6.2 Pick-up Reel

As with most types of baler, during pre-season preparation of the pick-up reel:

- **Check** for broken or loose tines. Replace / tighten as necessary
- **Straighten & refit** any bent or loose pick-up stripper bands
- **Check** condition & tension of the pick-up drive chain
- **Check** condition of the pick-up tine bar cam track *(located at the left-hand end of the pick-up reel).* Clean and repair / replace if necessary
- **Check** condition of the pick-up tine bar cam rollers for excessive wear and/or flat spots. Replace rollers if necessary *(replacements are available – see Section 11)*
- **Ensure** pick-up cam track is properly lubricated. Grease the nipple, rotate pick-up & re-grease
- **Check** the pick-up overrun / freewheel clutch for correct operation.

6.3 Crop Intake and Compression System

The components under the spotlight here are the baler's packing fingers, the packing plate and the baler's 'throat' *(see Section 5.3 for detailed description)*. Pre-season checking / setup should include:

- **Inspect** all components for mechanical damage. Straighten / repair as necessary
- **Ensure** the packing fingers and packing plate move smoothly through their cycles without rubbing on any nearby components.
- **Check** that the needle-to-packing finger timing is correct *(see Section 6.4.5 & Fig.6.22).*

6.4 Bale Tying System

The correct operation of a baler's tying system is absolutely essential. Unless it ties correctly & consistently, the baler simply can't function. However, the baler's knotters are often blamed for every kind of (mis)tying issue, when actually other things such as incorrect twine tension or twine routing can be responsible. It's important to keep an open mind when problem solving!

The knotting system of any square baler includes much more than just the Knotters. For the Bigbaler it includes the following components which all contribute to the correct tying of the bale:

- Knotter drive mechanism
- Knotter shaft or 'stack' – which includes the individual Knotter Units
- Twine Fingers
- Needles & needle drive mechanism
- Knotter Trip (plate) mechanism
- Knotter Brake & Non-return Pawl
- Twine tensioning system

What Type of Knotters?

The Bigbaler is fitted with three 'Deering'-type knotters made by the German manufacturer Rasspe. This type of knotter incorporates a moving knife / stripper arm which both cuts the twine & strips it off the Bill Hook to complete the knot.

The Bigbaler's knotters are a heavier-duty version of the type fitted to many conventional balers *(e.g. New Holland, John Deere, Deutz-Fahr, Bamford & Jones)*. However, they differ from those used on modern large square balers, both in terms of strength and operating principle.

Fortunately, Rasspe still manufacture very similar knotter today *(Fig.6.2)* and so the majority of Bigbaler knotter parts are still available *(see Section 11).*

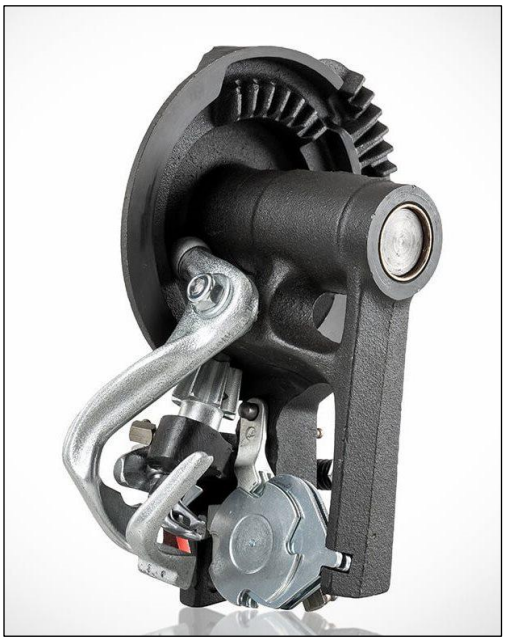


Fig.6.2 Modern Rasspe knotter - similar to that fitted to the Bigbaler *(courtesy Group Schumacher)*

Accessing and Working on the Bigbaler's Knotters

Despite being positioned at the front of the machine & *(partly)* visible from the tractor seat, unlike other square balers, the location & orientation of the Bigbaler's knotters makes it quite difficult to monitor their operation and very awkward to work on & adjust them. The knotter stack also restricts access to the twine fingers *(Fig.6.3 (left))*.

Most square balers allow the individual knotters to be rotated around the knotter shaft, to provide access for maintenance, adjustment & component replacement. This isn't possible on a Bigbaler.

Fortunately, on all but the earliest Mk1 machines *(before Serial No. 1063)*, the entire knotter stack *(shaft)* can be removed from the front of the machine *(see Fig.6.3 (right) & Section 6.4.2 for full details)*. Although a ~15 min & two-person job, this makes access to & adjustment of the knotter components very much easier and is well worth the effort.

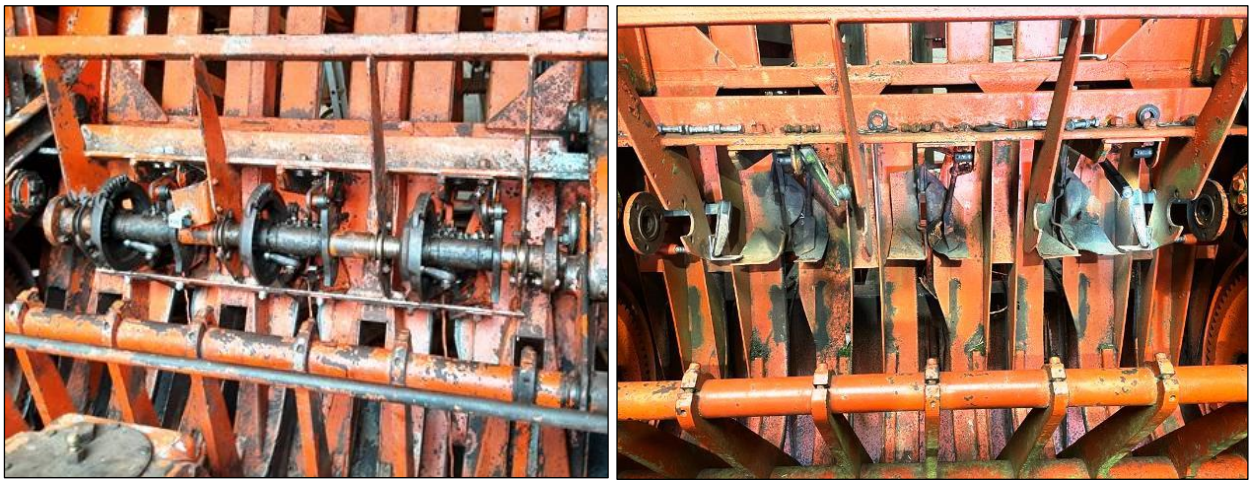


Fig.6.3 Bigbaler knotter stack - Installed *(left)* and following removal *(right & below)*
- Note ready access to knotters & twine finger mechanisms following removal

6.4.1 Knotter Drive Mechanism *(see also Section 6.4.6)*

The Bigbaler's knotter shaft and attached needle mechanism is driven by a *(large)* chain & sprocket from the *(right-hand)* packing finger drive gear *(Fig.6.4)*. The knotter drive sprocket *(on the end of the knotter shaft)* rotates continuously whenever the baler is working, but the knotters & needles are only required to operate intermittently *(once per bale)*, when manually tripped by the baler operator.

Consequently, as with most square balers, the Bigbaler's knotter drive incorporates a simple, mechanical clutch which *(during the tying cycle)* engages drive from the knotter drive sprocket to the knotter shaft & then automatically disengages itself afterwards.

The timing & duration of this operation *(which includes insertion & withdrawal of the needles)*, is critical to the correct operation of the baler's knotters.

So it's important to remove any slack or free-travel from the knotter *(shaft)* drive mechanism.

Fig.6.4 Knotter shaft drive chain & sprocket *(arrowed)*

In-service problems found in the Bigbaler's knotter shaft drive mechanism include excessive wear and/or free movement in the following components:

- Knotter drive chain - ***(Quite Common)***
- Knotter drive sprocket(s) - ***(Not so Common)***
- Knotter shaft drive keys & keyways - ***(Common on Mk1 but Mk2 used a stronger, multi-spline drive)***
- Knotter shaft / stack drive flanges – Cracks originating from flange keyways - ***(only on Mk1 balers)***

Drive Sprocket Bush Wear

The most common & perhaps most important problem found on virtually all Bigbalers concerns excessive wear in the knotter drive *(clutch)* assembly, specifically:

- **Knotter *(sprocket)* drive 'dish'**
  - Wear in central brass bush causing excessive movement on the knotter shaft *(Figs 6.5 & 6.7)* - ***(Very common on all balers)***
- Partial withdrawal of knotter trip arm pivot pin leading to wear in the pivot pin inner locating hole in the knotter trip flange *(Fig.6.6)* - ***(A direct consequence of the above)***

This problem is largely the result of an inadequate design for the size of the machine and the way in which the knotter's drive mechanism operates. The knotter shaft drive sprocket is attached *(via the knotter drive shearbolt)* to the knotter drive 'dish', which runs on the knotter drive shaft, supported by a *(central)* brass bush *(Figs 6.5 & 6.7)*. The drive 'dish' fits over the knotter trip arm assembly *(Fig.6.6)*.

When the knotter is 'tripped', the trip arm roller moves outwards and contacts a drive cam inside the knotter drive 'dish' *(Fig.6.7 (arrowed))*. This engages what is in effect a 'dog clutch' and transfers drive from the sprocket to the knotter shaft.

The mechanism works extremely well, **BUT** the knotter drive 'dish' rotates on the *(stationary)* knotter shaft whenever the baler is under power *(except during the tying cycle)*. The weight and tension of the knotter drive chain, which acts on the knotter drive sprocket, passes entirely through the greased brass bush which is rotating on a hardened steel shaft. Wear is inevitable.

This type of design works well on conventional balers, but their driveline loading levels are much lower. The Bigbaler needed a much stronger design, but didn't receive it. The Mk2 baler used a larger diameter bush, but the problem of excessive wear remained.

If wear in the knotter drive 'dish' bush is not addressed, misalignment can occur within the knotter trip mechanism, leading to excessive wear of the trip arm, trip roller and drive pawl. ***Very Bad News!***

Additionally, the trip arm pivot pin is not actually secured in the knotter trip flange *(Fig.6.6 (arrowed))*. The pin relies on contact with the inside face of the knotter drive 'dish' to keep it in place. When the brass bush wears, the drive 'dish' will 'wobble' on the knotter drive shaft *(see Video Clip)*.

Over time this can become quote severe and allow the pivot pin to partially exit its locating hole in the knotter trip flange, creating wear inside the hole and misalignment of the knotter trip arm.

Fig.6.5 Knotter shaft sprocket & 'dish' – Central brass bush *(arrowed)*

Fig.6.6 Knotter trip arm assembly – Trip arm pivot pin *(arrowed)*

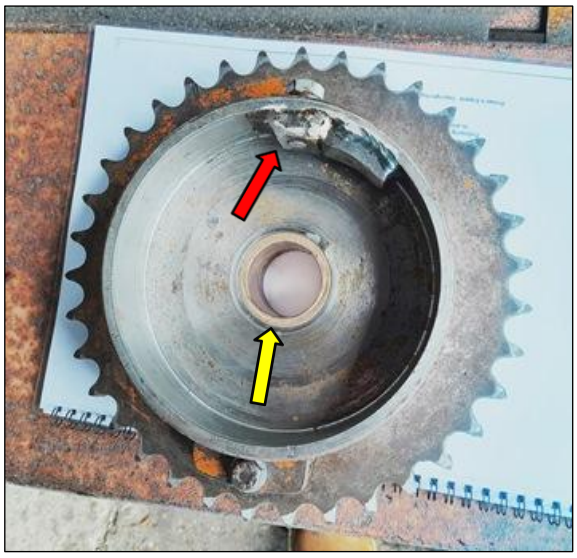
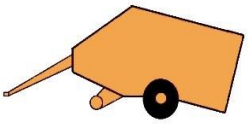


Fig.6.7 Knotter drive 'dish' interior
- Central brass bush *(Yellow arrow)*
- Knotter drive cam *(Red arrow)*

Knotter Drive Sprocket Wobble?

- ***Does your Knotter* Drive *Sprocket wobble on its Shaft?***
- ***If it Does – Do Something about it***
- ***REMEMBER – No Knotter Drive = No Baling***



Click on the Baler icon or scan the QR code for video

These are bespoke *(Howard-manufactured)* components and spares are no longer available, so it is **very important** to identify & address these issues before real damage is done. If caught early, they can be corrected relatively simply & cheaply.

- A replacement brass bush can be manufactured & installed by most machine shops
- A worn hole in a knotter trip flange can be bored-out & bushed back to size or an oversize pivot pin be made & fitted

N.B. All knotter drive cams found to-date have been modified by the welding of an additional cam section inside the knotter drive 'dish' *(Fig.6.7)* – This was probably a Dealer modification.

6.4.2 Knotter Shaft / Stack

Believe it or not, the strength / robustness of a baler's knotters is defined by the diameter of the knotter shaft. Bigger / stronger knotters require a thicker shaft. Conventional *(small)* square balers typically use a Ø30 mm shaft whereas modern, high-density large square balers use a Ø40 mm shaft. The Howard Bigbaler falls somewhere in-between & uses knotters mounted on a Ø35 mm shaft.

This information is not as mundane as you may imagine because the entire knotter specification & many of its replacement components depend on the shaft diameter. **So remember Ø35 mm.**

Most issues which concern the knotter stack are addressed during servicing of the knotter units *(see Section 6.4.3)*, which is usually performed 'on the workbench' following removal of the knotter stack *(see Fig.6.3 & below).* However, one particular thing sometimes gets overlooked:

- **REMEMBER** to lubricate *(oil)* the knotter shaft support bearings. These *(four)* plain brass bushes are easy to overlook & can seize on the shaft, causing them to rotate in their housings & wear.
    - It's important that the knotter shaft can **both** rotate freely in the bearings **and** slide slightly *(left-right)* inside them. Stiff or seized bearings also hamper knotter setup & adjustment.

Knotter Stack Removal *(see Fig.6.3)*

This isn't required for all types of knotter servicing & adjustment *(see Table 3)*, **BUT** it does make many tasks very much easier and so is well worth the effort.

With the Bigbaler's packing finger drive mechanism in a **Safe or Locked position** *(see Section 5 – Introduction)*, the procedure to follow is:

- Tie-up the twine finger cam rollers
- Unbolt the *(four)* knotter shaft bearings from the support frame
- Unbolt the knotter shaft drive flanges *(each end)* and lever the flanges apart slightly. **Remember to** *(chisel or dot punch)* **mark the adjacent flanges before you unbolt / separate them**
- Lift out the knotter stack towards the front of the machine *(probably a two person job).*

As all the workshop manuals say, *"replacement is simply a reversal of the removal procedure"*. Well it never is and it isn't in this case; not quite:

- When replacing the Stack, it is necessary to hold each of the three knotter 'frames' in almost horizontal position so that their 'mounting tabs' each engage with a slot on the Bigbaler's knotter support frame *(definitely a two-person job)*
- Re-aligning the bolt holes in the shaft drive flanges can also be entertaining. An old, pointed screwdriver with the bottom end of its shaft heated & bent through 90^{o} can be helpful here.

The knotter support frames of very early Mk1 Bigbalers *(before Serial No. 1063)* were not slotted to permit easier knotter stack removal. However, these support frames can be modified *(slotted)* to match those of later machines and so aid stack removal.

6.4.3 Knotter Units

Most baler operators know how a Deering-type knotter works *(see the Operator's Manuals which may be downloaded from Section 13)*. In essence:

1) Both ends of the twine *(from the start & end of the bale)* are laid across the Bill Hook *(with help from the Twine Finger)* and held by the Twine Retainer Disc *(sited just above the Bill Hook)*

2) The Bill Hook rotates & winds the two strands of twine around its body, to form a loop

- As it does so, the Bill Hook Jaw opens & grasps the upper part of the twine

3) The Knife / Stripper arm moves across & simultaneously:

- Cuts both strands of twine between the Bill Hook & the Twine Retainer Disc
- Strips the loop of twine off the Bill Hook body

4) Because the cut ends of the twine are held in the Bill Hook Jaw, as the twine loop is stripped off the Bill Hook, the twine ends are effectively pulled through the loop to form the Knot.

Knotter Pre-Season Checks & Setup/Adjustment

With the possible exception of Twine Retainer and/or Bill Hook clamping pressure, the items listed in Table 3 are good things to check / adjust **BEFORE** attempting to bale. Their correct setting won't necessarily ensure perfect knotter performance, but their incorrect setting will eventually lead to problems. Get them set right at the start & the battle will be more than half-won.

- **BUT REMEMBER -** Mis-tying & twine breakage can be caused by other things than poor knotter performance. Remember to check for incorrect twine tension & other possible causes *(see Sections 6.5 & 9)*

- Unlike most other balers, Bigbaler knotter pre-season setup / adjustment is made so much easier if the Knotter Stack is removed from the machine, but this isn't necessary for all tasks *(see Table 3)*

- If the Knotter Stack is removed, support its ends on a pair of axle stands or *(better still)* grip them in a pair of DIY portable workbenches.

  - Each knotter unit can then be rotated by-hand around the *(stationary)* knotter shaft and will go through its normal tying cycle in controlled conditions. ***(N.B. Remember to rotate the knotter in the right direction)***

  - **ALWAYS** hold the knotter by its mounting tab *(Item Z in Fig.6.8)* and keep your fingers away from the *(sharp, potentially moving)* knotter components.

Table 3 Howard Bigbaler – Likely Knotter component issues and remedies

Knotter Component	Likely Issue	Remedy	Knotter Stack removed?
Stripper / Knife Arm Travel	• Insufficient Stripper Arm travel beyond tip of Bill Hook • Should be 13 – 16 mm (½ - ⅝ ins) at max. travel ***(see Fig.6.8)***	• Renew Stripper Arm cam roller • Renew Knotter Cam Gear if badly worn	Yes
Bill Hook – Stripper Arm clearance	• Stripper/Knife Arm shouldn't contact the Bill Hook at any point during Knotter operation **EXCEPT** to rub across the Bill Hook's heel ***(see Fig.6.9)***	• Contact may occur between the Twine Knife & the Bill Hook tip • Consider packing the Knife Blade out slightly from the Stripper Arm & reattach it with longer bolts	Yes
Stripper Arm - Bill Hook contact	• Either excessive or insufficient Bill Hook – Stripper Arm clearance during Stripper Arm travel • Stripper Arm should rub lightly across the heel of Bill Hook ***(see Fig.6.10)***	• Remove Stripper Arm & grip in a **strong** vice • Hit **very gently** with a **BIG** hammer to bend arm & obtain correct clearance • Refit & check clearance between each small adjustment • **Don't** try to heat & bend the Arm	Yes
Twine Knife	• Blunt Twine Knife	• Remove Knife Arm, sharpen knife & replace	No
Twine Retainer Disc	• Incorrectly timed	• Adjust disc timing ***(see Fig.6.11)***	Yes
Bill Hook	• Slightly rough or pitted surface	• Polish with fine 'wet & dry' paper • Always protect Bill Hooks against rust during winter storage	Not vital, but easier
	• Very rough/pitted surface or damaged component	• Replace Bill Hook	Yes
	• Vertical free-travel in Knotter Frame	• Shim under Bill Hook drive pinion	
Bill Hook or Twine Retainer Disc	• Excessive rotational free-travel	• Check for excessive Knotter Cam Gear to Drive Pinion clearance & re-shim Knotter Stack if necessary ***(see Fig.6.12)*** • Replace worn Drive Pinion(s) • - Replace worn Knotter Drive Gear	Yes
Twine Retainer or Bill Hook Jaw	• Insufficient clamping pressure • Excessive clamping pressure	• Adjust respective spring pressure(s) • Spring adjustments are very sensitive	No

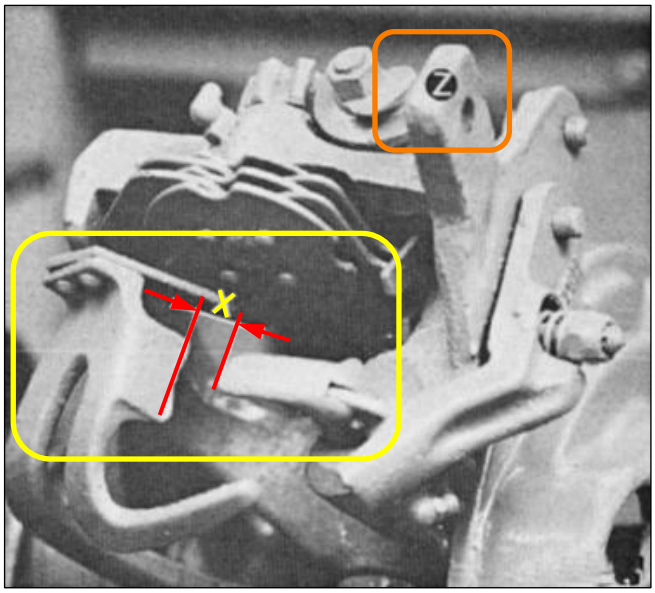


Fig.6.8 Knotter Stripper Arm at maximum travel
- Arm should clear Bill Hook tip *(Distance 'X')* by 13 - 16 mm (½ - ⅝ ins)
- Item 'Z' is the Knotter Mounting Tab

(courtesy New Holland)

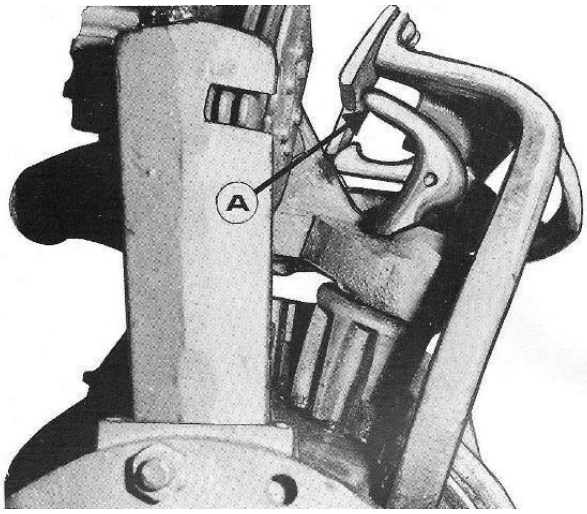


Fig.6.9 The Knife/Stripper Arm should not contact the Bill Hook (A) during the tying cycle **EXCEPT** to rub across the Bill Hook's heel

(courtesy New Holland)

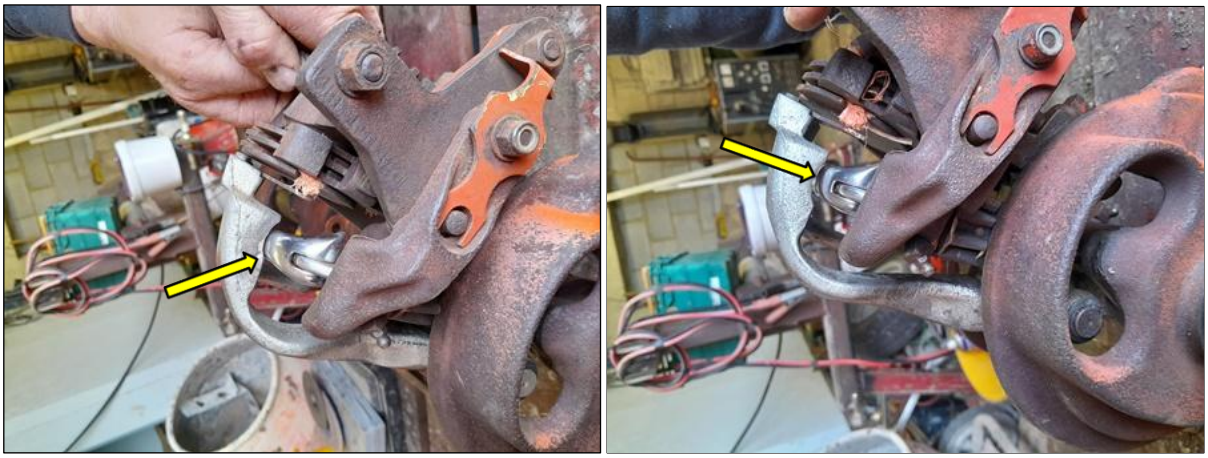


Fig.6.10 The Stripper Arm should rub lightly across the Bill Hook's heel *(left - arrowed)*
- Excessive Stripper Arm – Bill Hook clearance *(right - arrowed)*

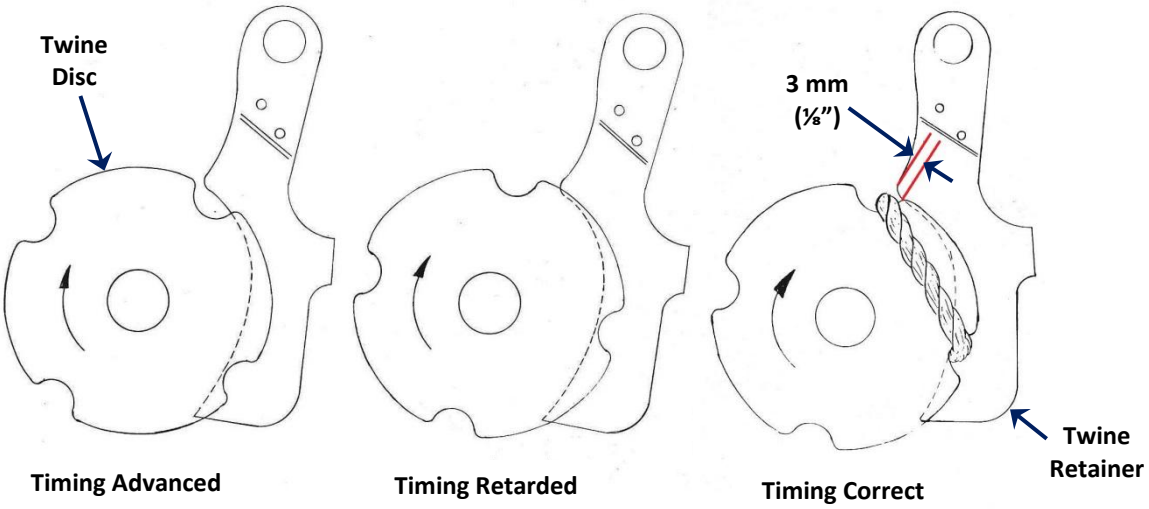


Fig.6.11 Twine Retainer Disc timing – Timing is correct if *(after each tying cycle)* the leading edge of the disc notch is 3 mm (⅛") past the front corner of the Twine Retainer *(right)*

N.B. *Ensure a piece of twine is gripped by the previous notch when checking the disc timing. Simply insert an inch-long offcut into the open notch, turn the knotter through a cycle & then check the timing of the next (empty) notch*

(courtesy New Holland)

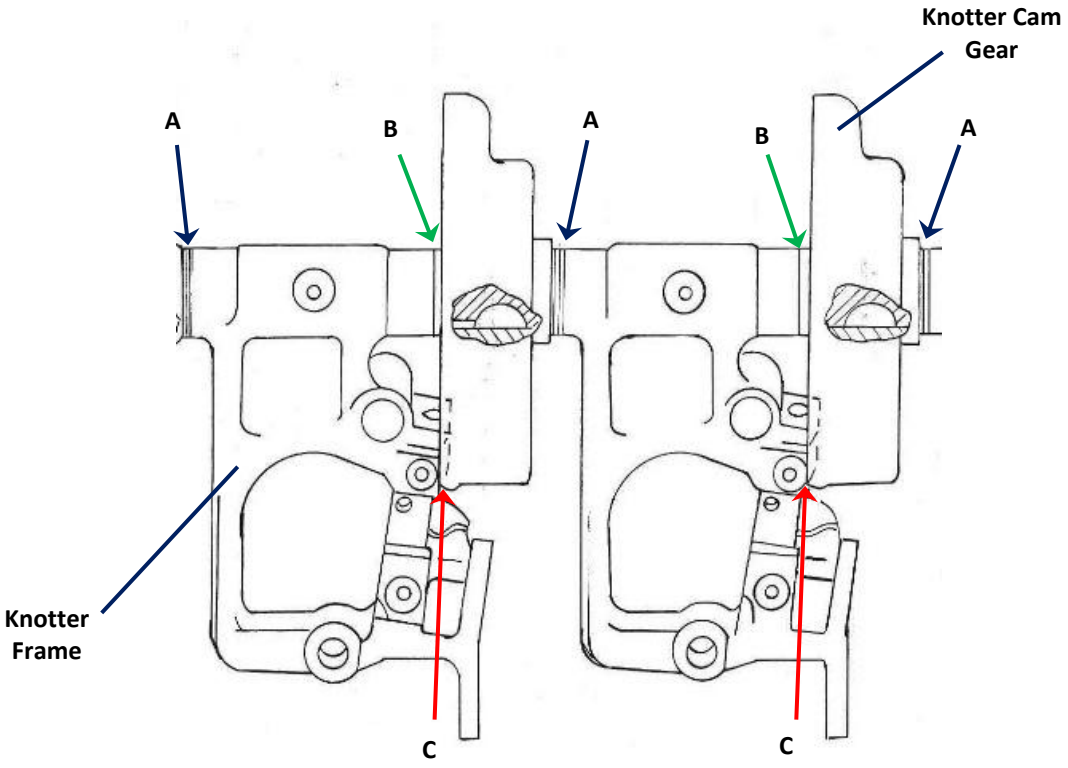


Fig.6.12 Knotter 'stack' end float adjustment – Progressively add shims at Points 'A' and ***(very gradually)*** remove shims at Points 'B' until *(with the drive flanges tightened on each end of the knotter shaft)*, it is possible to rotate each knotter frame against the Cam Gear face with minimal clearance at Points 'C' *(less than 0.4 mm (0.015"))*. **Don't overdo the adjustment!**

6.4.4 Twine Fingers

The twine fingers play an important role in helping the knotters perform reliably but, being hidden behind & slightly below each knotter unit *(Fig.6.13)*, they all too often get forgotten about.

Each knotter has a twine finger, operated via an adjustable linkage from a cam on the knotter shaft. During the tying cycle the twine fingers open & close twice *(Figs 6.14 & 6.15)*, firstly to avoid the incoming needle & secondly to clear the stripper/knife arm.

As the Twine Finger closes after its first opening cycle, it catches the No.2 twine presented by the Needle and pulls it against the side of Bill Hook. This ensures that when the Bill Hook rotates, its jaws will reliably grasp the twine and make a knot.

It is important that the twine fingers are properly adjusted in terms of their:

- Vertical position
- Shaft angle
- Extent of travel & closed position

Different designs of twine fingers were used on Mk1/1a and Mk2 balers, but the later type was often retrofitted to earlier machines.

Pre-season checking / setup should ensure that the twine fingers:

- **Open & close freely** - They can stick, partially seize and/or debris can restrict their movement
- **Don't hit any other components** during the tying cycle *(e.g. needles or knife arms)*
- **Return springs** are present & not weakened
- **Have the correct clearance** *(from either the baler's frame or the operating cam)* when in the 'closed' position *(see Op's Manual)*
- **Don't exhibit any *(twine)* wear grooves.**

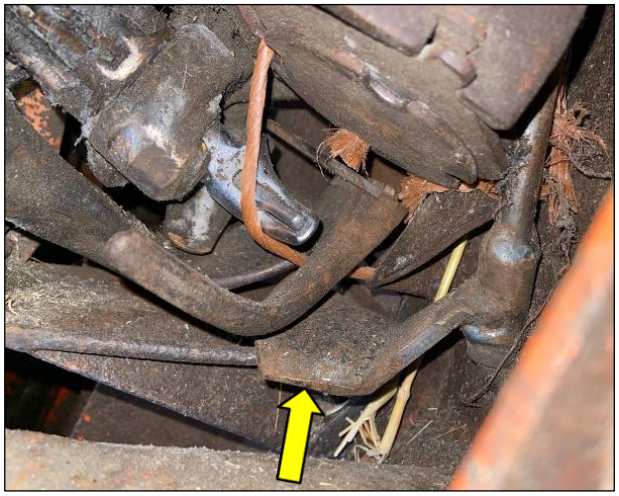


Fig.6.13 Mk1 Bigbaler twine finger *(arrowed)* in closed position – **Note** twine pulled across side of the bill hook

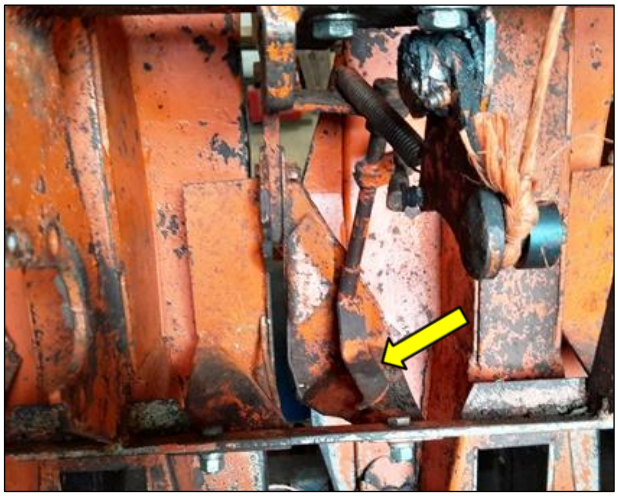


Fig.6.14 Mk2 Bigbaler twine finger *(arrowed)* in open position – ***(N.B.** Knotter stack removed)*

Fig.6.15 Mk2 Bigbaler twine finger in closed position

6.4.5 Needles

The Bigbaler's needles are located below the bale chamber, mounted on a pivoting frame *(see Figs 3.2 & 6.18)*. This is connected, via crank arms & connecting rods on each side of the baler, to the ends of the knotter shaft *(see Fig.6.23 (right))*. When the Knotter Shaft rotates during the tying cycle, the Needles pass through slots in the baler's throat *(Fig.6.22)* and deliver the *(No.2)* twine ends to the Knotters. They then retract back to their 'at-rest' position.

Needle movement all happens very quickly during the tying cycle, but for successful knotting their operation & movement in relation to other (fixed) components must be very precise. So, sooner or later, free-travel or wear is likely to cause either tying troubles or severe needle or knotter damage.

N.B. Replacement needles are now virtually unavailable, so treat your Bigbaler's needles with great care. Remember the baler can't operate without them!

Needle Design and Construction

Two different types of twine needle were fitted to Bigbalers:

- **Mk1/1a** Fabricated steel 'U'-shape section with an integral steel loop 'eye' *(Figs 6.16 & 6.17)*
- **Mk2** Cast aluminium with grooved stainless steel roller in the 'eye', retained by a roll pin *(Fig.6.18)*

Fig.6.16 Bigbaler Mk1/1a Needle – upper surface *(left)* and underside *(right)* showing channel for passage of twine *(arrowed)*

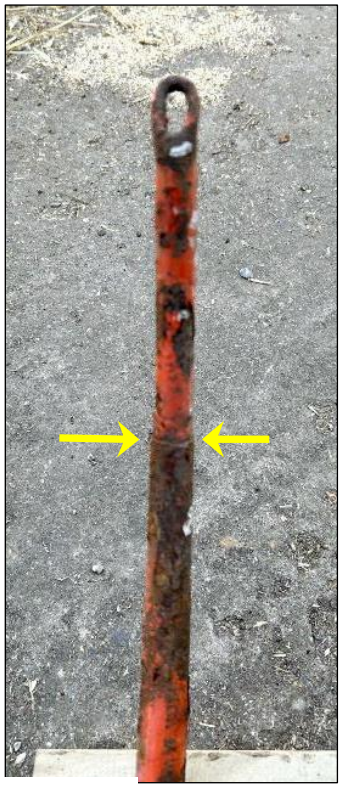


Fig.6.17 Bigbaler Mk1/1a Needle – side view *(above)* and tip detail *(right).* Point of change in needle section width *(arrowed)*

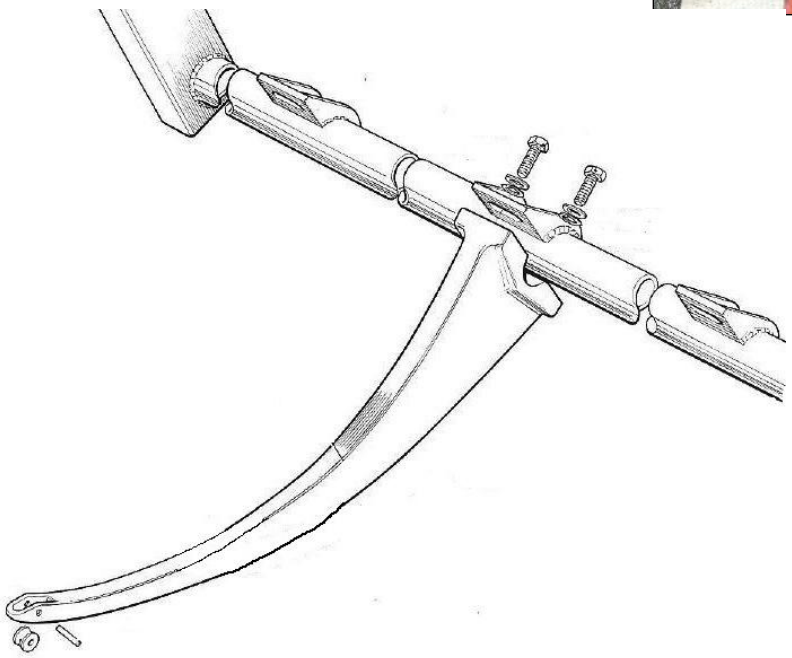


Fig.6.18 Bigbaler Mk2 cast aluminium Needle showing method of attachment to the Needle Frame

(courtesy Howard Rotavator Co.)

N.B. The section width of Mk1/1a needles increases slightly, a few inches back from the tip *(Fig.6.17)*. This is just a quirk of the design & doesn't affect the needle-to-knotter component clearance settings because only the narrower part of the needle passes through the knotter during the tying cycle. The external width of the Needle 'eye' should be almost the same as that of the initial *(narrow)* section of the Needle. If it isn't, **carefully** modify it.

Needle Mounting & Adjustment

The different needle types also mount onto to the Needle Frame cross-tube in a different way. This affects the ease with which their position & working clearance to the knotter components can be adjusted:

- **Mk1/1a** Clamped to the Needle Frame tube by two split, circular clamps *(Fig.6.19)* **and** a threaded stud on the needle base *(Fig.6.20 (left))* protrudes through a *(slotted)* plate welded to the Needle Frame underside, and is secured by a nut on either side of the plate *(Fig.6.20 (right))*.

  Needle *(vertical)* position is adjusted by slackening one securing nut and tightening the other, having first loosened the mounting clamps. Careful, even retightening of the clamps is necessary following adjustment. **Unfortunately, none of this is mentioned in the Operator's Manual**

- **Mk2** Bolted to a slotted bracket welded to the Needle Frame *(Fig.6.18)*. A simpler & more secure mounting than on Mk1/1a machines. Needle *(vertical)* position is adjusted by slackening one mounting bolt and tightening the other, in turn.

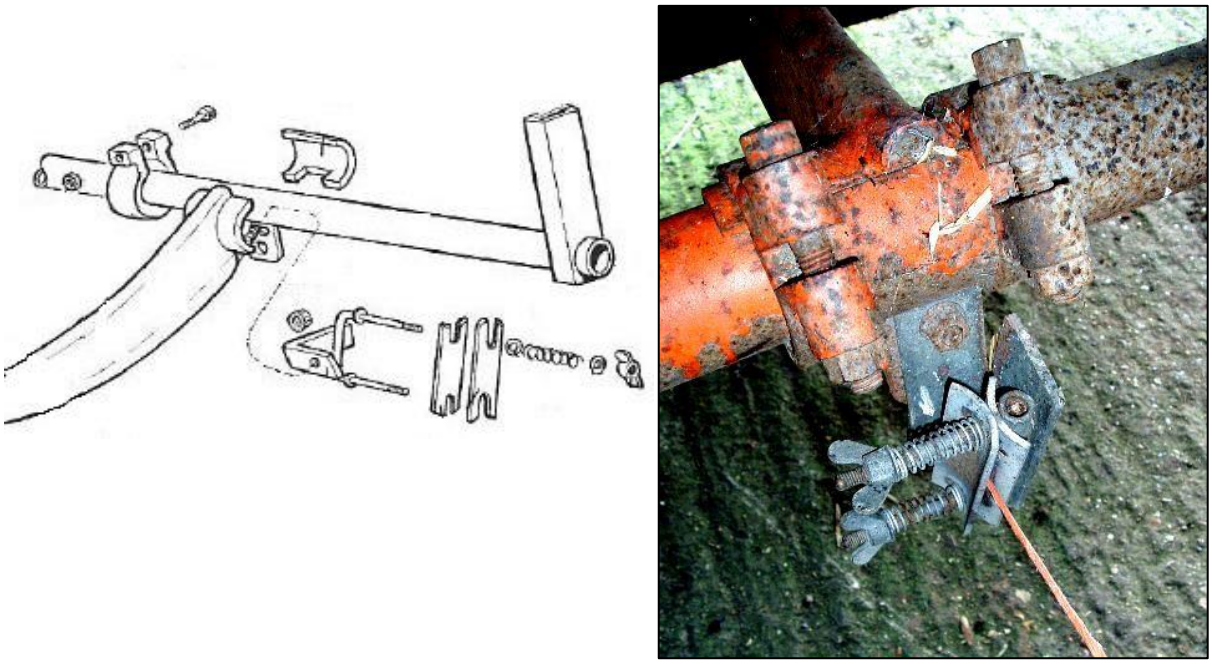


Fig.6.19 Mk1/1a Needle mounting – Needle is clamped to the *(tubular)* Needle Frame & the stud on base of the Needle passes through and is secured to a slotted plate, welded to the underside of the frame.

- The plate and stud also provide the mounting for the needle-mounted twine tensioner

Users have found that Mk1-type needles can be fitted successfully to Mk2 balers, **but only** if a Mk1/1a Needle Frame is substituted *(so that the appropriate needle mountings are provided)*.

It is not known whether Mk2-type needles can be fitted to Mk1 machines. However, the different twine routing arrangement used on Mk1/1a balers *(see Section 6.5)* potentially makes the use of Mk2 needles very difficult on these machines without considerable modification, even if an appropriate needle frame were fitted.

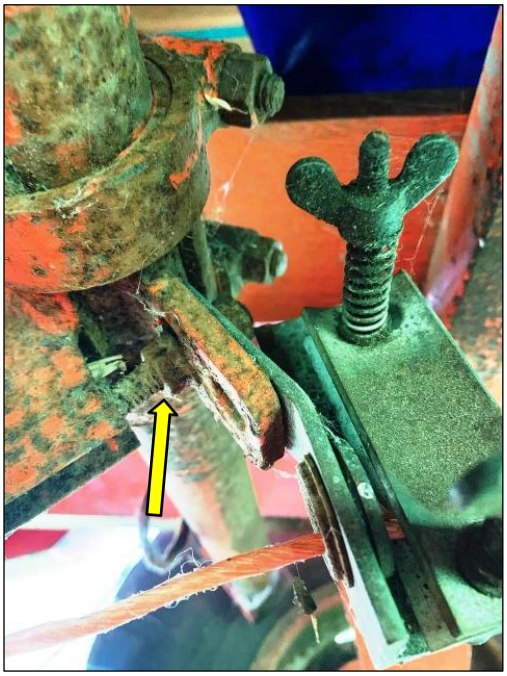


Fig.6.20 Mk1/1a Needle mounting / adjusting stud *(above - circled)*, secured to plate on underside of Needle Frame *(right - arrowed)*

- Note *(Mk1a)* mounting of the Needle Twine Tensioner

Needle Setup Before Work

During pre-season checking & setup of the Bigbaler's needle assembly:

- **CHECK** that there is not excessive sideways movement between the Needle Frame & the baler's chassis. This could cause the Needles to hit the Knotter Frames during the tying cycle. Where necessary, insert shim washers to remove free play
- **CHECK** that the Needles are aligned with & pass through the centre of the slots in the baler's throat *(Fig.6.22).* Move the Needles sideways *(slightly)* on the Needle Frame so they do, **BUT then ALSO:**
- **Trip the Needles and turn the baler over by-hand** *(perhaps with help from an assistant)*.
- **CHECK** that as each Needle passes through the Knotter unit:
  - The side of the Needle **rubs lightly** on the Knotter Frame at Point 'A' *(Fig.6.21 (red arrow))*

    - This helps to stabilise the Needle, so that it delivers the twine to the right place
  - The Needle's inner face clears the Twine Retainer Disc **and** the Disc Cleaner by 3 mm (⅛ ins) *(Fig.6.21)*

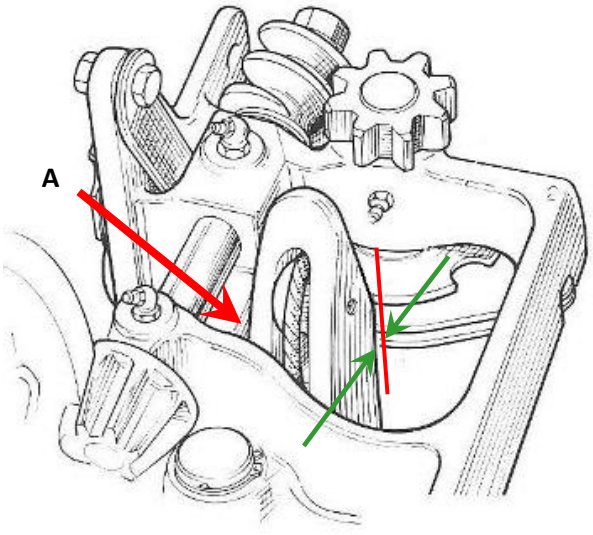


Fig.6.21 Needle tip passing through knotter unit

- Side of needle should rub lightly on knotter frame at Point A' *(Red arrow)*
- Needle inside face should clear twine retainer disc & disc cleaner by 3 mm (⅛ ins)

- **CHECK** that the Needle-to-Packing Finger timing is correct.

  Trip the Needles and turn the baler over by-hand *(perhaps with help from an assistant)*.

  The Needles should begin to move / enter the baler's throat just after the tips of the packing fingers have passed the needle tips *(Fig.6.22).*

  If needle timing is not correct, reset as per the instructions provided in the Operator's Manual *(see Section 13).*

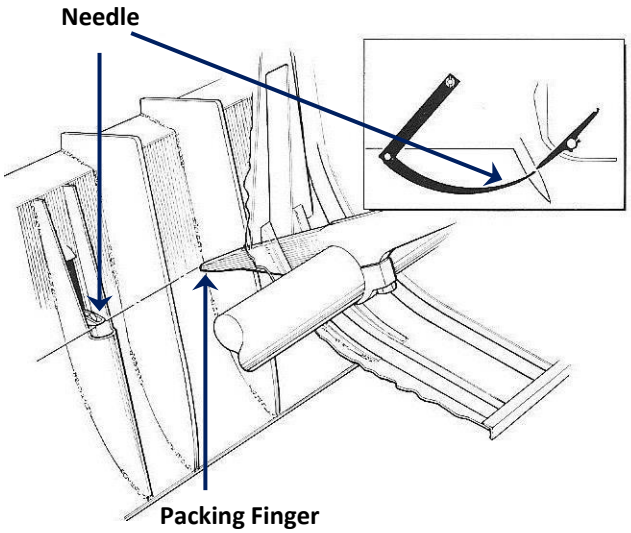


Fig.6.22 Correct Needle - Packing Finger timing

(courtesy Howard Rotavator Co.)

- **CHECK** the clearance between the top of needle mounting tube & the underside of the baler's chassis when the needles are 'at-rest' *(Fig.6.23 (left))*. The adjustment procedure is given in the Operator's Manual.
- **ALSO CHECK** the orientation *(angle)* of the Knotter Crank Arms on each end of the Knotter Shaft *(Fig.6.23 (right))*, **particularly on Mk1/1a balers.** The left & right-hand crank arms should point in exactly the same direction, but wear & partial failure of the knotter shaft drive keyways *(see Sections 6.4.1 & 9.2)* can cause them to become slightly misaligned. This can result in uneven movement of the Needle Frame and needle misalignment. Check for even protrusion of the needle tips into the baler's throat and remove any free-play from the knotter shaft drive.

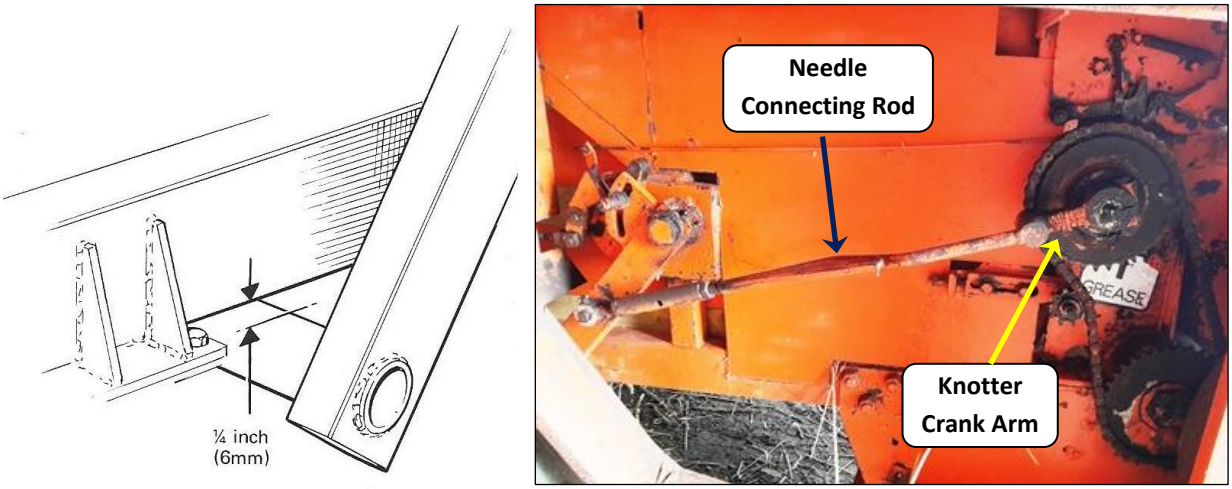


Fig.6.23 Needle frame - baler chassis clearance – When the knotter crank arms & needle connecting rods are in a straight line *(right)*, there should be at least a 6 mm (¼ ins) gap *(left)*

6.4.6 Knotter Brake & Pawl

The Knotter Brake & its integral non-return Pawl are often-overlooked & neglected components **BUT** they play an important role in ensuring the correct operation of the Bigbaler's knotting system. Keyed or splined on to the left-hand end of the knotter shaft, the brake & pawl act in combination:

- **Knotter Brake:** Ensures the knotters trip correctly *(see Section 6.4.7)* and that the knotter shaft & needles operate smoothly, don't overrun and only move when they are meant to *(i.e. when under power)*
- **Brake Pawl:** Prevents the Knotter Shaft from turning backwards

Preventing unintentional needle movement is particularly important.

Although it's operated by the Knotter Crank Arms & Connecting Rods *(see Fig.6.23 (right))*, if these components get out-of-line & the Knotter Brake doesn't function, the sheer weight of the Needle Frame can cause it to drop down as the baler bounces over rough ground *(or during road transport).* The needle tips will then enter the baler's 'throat' and be damaged or broken by the packing fingers and/or the incoming crop when baling begins again.

Most square balers have a mechanism to prevent the baler from operating if the needles move from their 'at-rest' position, but unfortunately the Bigbaler doesn't.

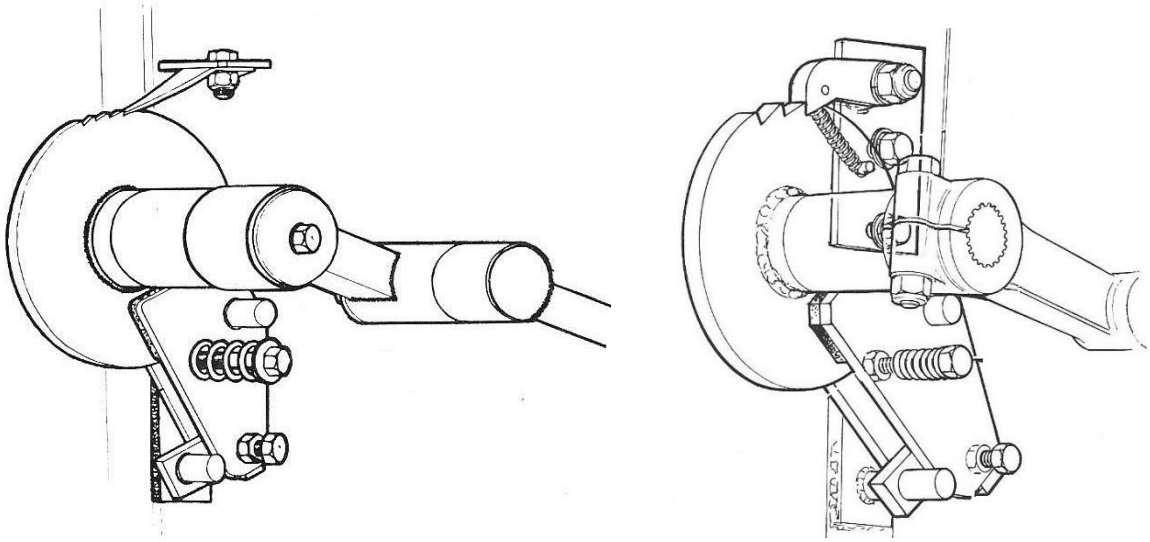


Fig.6.24 Knotter brake & *(non-return)* pawl unit – Mk1/1a baler *(left)* and Mk2 baler *(right)*

(courtesy Howard Rotavator Co.)

The Mk1/1a and Mk2 balers used slightly different brake disc & pawl designs *(Fig.6.24)*, but both operate reliably, if set correctly & maintained.

- **Mk1/1a** Brake disc keyed to knotter shaft. *(Adjustable)* spring steel non-return pawl
- **Mk2** Brake disc splined onto knotter shaft. Stronger, spring-loaded, pivoting non-return pawl

Fig.6.25 Re-lined Bigbaler knotter brake pads *(Replacement lining thickness = ~4.0 mm)*

During pre-season preparation & setup of the knotter brake & pawl:

- **Remember that it's meant to be a Brake!** Treat it like any *(vehicle)* disc brake which you'd like to work:
  - **DON'T** let the brake disc get covered in oil, grease or paint(!) **or** become rusty. Keep it smooth & clean
  - **REPLACE/RENEW** the brake pad friction linings **before** they wear out. The original backing plates can be easily re-lined by most local brake re-manufacturing companies *(Fig.6.25)*
- **ENSURE** the pawl notches on the edge of the brake disc are not worn. Rebuild if necessary
- **ENSURE** the brake pad *(spring)* clamp force on the brake disc is correct *(see Section 6.4.7 for setup procedure)*:
  - **Brake Too Tight:** the Knotter drive mechanism will 'chatter' and/or be overloaded
  - **Brake Too Loose:** the Knotters may fail to trip correctly, the Needles may enter the baler's 'throat' by themselves and/or the Twine Finger Cam Rollers may overshoot the top of the cam *(Fig.6.27 shows correct 'at-rest' position).*
- **CHECK** that following a tying cycle, the Brake Pawl sits in the 3rd *(rearmost)* notch in the knotter brake disc *(see Section 6.4.7 for setup procedure)*.

6.4.7 Knotter Trip Plate

The Knotter Trip Plate is located on the right-hand side of the baler, immediately above the knotter shaft drive sprocket *(see Figs 6.5 & 6.26 (right))*. At first glance it's a series of pivoting, spring-loaded catches which, when triggered by the baler operator pulling a trip cord, permits the Knotter Trip Arm to engage drive to the Knotters. **However,** it's slightly more complex than that because:

- Once the knotters have completed their tying cycle *(i.e. one rotation of the knotter shaft)*, the trip plate's spring-loaded Release Lever must re-engage with the Knotter Trip Arm, to disengage drive to and stop the knotters
- The Trip Plate is adjustable (fore-aft). Whilst this doesn't affect the relative timing of the baler's components during the tying cycle, it does affect when the cycle starts and ends. It also can affect how readily the baler's knotters will engage when tripped. **So it's fairly important!**

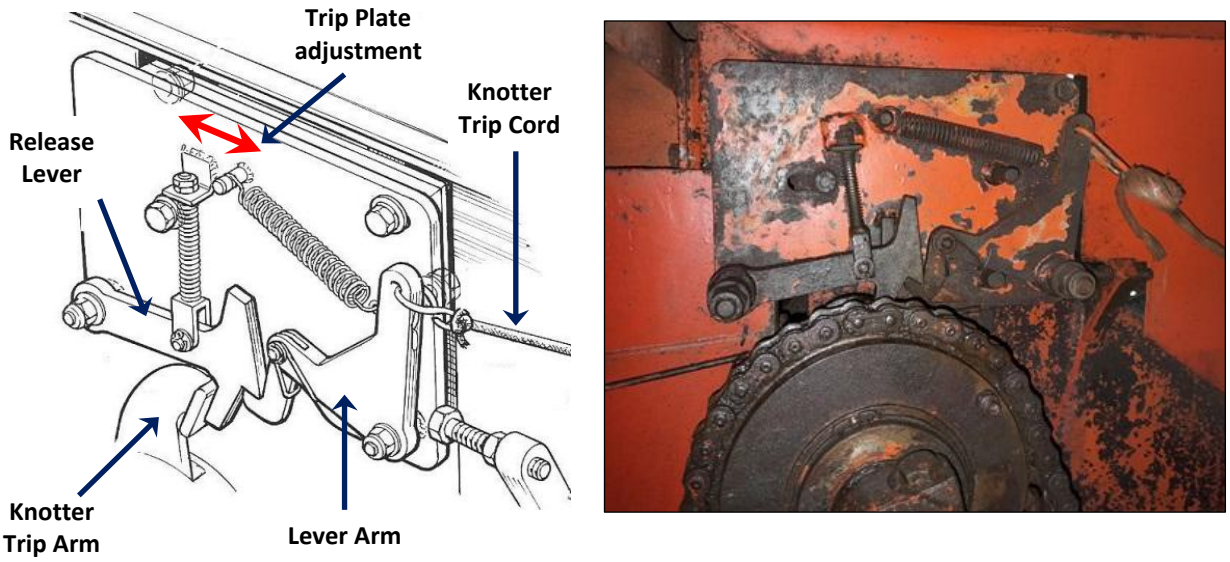


Fig.6.26 Bigbaler Knotter Trip Plate

If a Bigbaler's Knotter Trip Plate *(and/or its Knotter Brake)* is set incorrectly, the knotter drive mechanism can 'chatter' in-work. 'Chatter' occurs when the drive roller of the Knotter Trip Arm partly contacts the Knotter Drive Cam when the knotters are not actually tripped.

This can result from a number of things, but the underlying causes are:

- The Knotter Shaft coming to rest *(following a tying cycle)* in the wrong *(rotational)* position
- Incorrect *(fore-aft)* position of the Knotter Trip Plate *(Fig.6.26)*.

The difficulty is that each of these issues can affect the other so, if you're not careful, you can get into a *'chasing your own tail'* situation.

The Knotter Drive mechanism will 'Chatter' if the:

- Trip Plate assembly is set too far forwards, and/or the:
- Knotter Brake is set too tight

BUT if the Knotter Brake is set too loose, the:

- Knotters may fail to trip correctly
- Needles may enter the baler's 'throat' of their own accord
- Twine Finger Cam Rollers may overshoot the top of the cam *(following the tying cycle).*

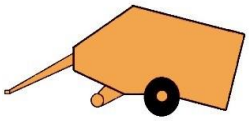
Knotter Trip Plate & Brake Disc/Pawl Setup

Unfortunately, the Bigbaler Operator's Manual rather contradicts itself regarding this matter. However, the following setup procedure has been found to work:

- **Start** with the Knotter Trip Plate approx. midway *(fore-aft)* in its mounting slots
- **Ensure** the Twine Finger Cam Rollers are on top of **or** just before the crest of the operating cams *(on the Knotter Stack – Fig.6.27)*
    - When in this position the Knotter Crank Arm & the Needle Connecting Rods should be more or less in-line *(see Fig.6.23 (right))*. If not, there's a potentially serious mechanical problem with the knotter shaft or the knotter drive mechanism.

- **Keeping** the Knotter Shaft stationary, **adjust** the Knotter Brake Pawl so that it sits in the 3rd *(rearmost)* notch in the Brake Disc with 1.5 – 3 mm (1/16 - ⅛ ins) clearance between the Pawl's tip and the notch
- **Remove** all tools, **close** all guards & run-up the baler at *(thatching straw)* operating speed
- **Ensure** that after each trial tying cycle the:
  - Twine Finger Cam Rollers return to the top **or** just in front of the top of their operating cams *(Fig.6.27)*
  - Knotter Brake Pawl returns to the 3rd *(rearmost)* notch in the knotter brake disc *(Fig.6.24)*
  - Knotter drive mechanism does not Chatter
    - **If** the Cam Rollers are not far enough up their cams **and/or** the Brake Pawl doesn't get as far as the 3rd notch, **move the Trip Plate forwards slightly**
    - **If** the Cam Rollers overshoot the top of the cams *(when in the 'at-rest' position)*, **tighten the Knotter Brake slightly**
    - **If** the drive mechanism does Chatter, either:
      - **Move the Trip Plate rearwards slightly,** or
      - **Slightly loosen the Knotter Brake**.

Fig.6.27 Twine Finger Cam Roller
- Correct 'at-rest' position on the operating cam



Click on the Baler icon or scan the QR code for video of Knotter Stack operation

6.5 Twine – Specification, Routing and Tensioning

Bigbaler Twine Specification & Quality

Most Bigbaler operators already know this, **BUT**:

- **ALWAYS** use the correct grade of *(decent quality)* twine in your Bigbaler
  - Poor quality twine will cause twine tensioning problems & poor knotter performance
  - This issue plagued early Bigbalers because good-quality twine wasn't available, but it is today

- Most Bigbaler operators use '8600' grade polypropylene twine *(~150 – 160 m/kg thickness)*
  - '9250' grade is also acceptable, but it isn't so widely used
  - '10,000' grade 'hay' twine is too thin
  - '7200' grade high-density large square baler twine is too thick/strong
  - Remember the Bigbaler's knotters are only a slightly up-rated version of a conventional baler knotter: they are not as robust as a Large Square Baler's knotters and can't handle substantially thicker twine.

- '8600' grade twine is available from most twine manufacturers **BUT check the spool's external dimensions**. Twine spools of some brands are too 'fat' to fit in the Bigbaler twine boxes, so check before you buy! **Spools must not be larger than ~270 mm diameter** *(Fig.6.28)*
  - This spool size will fit inside the Mk1/1a twine box, albeit after slight 'modification'. However, it is only possible to accommodate a single row of *(three)* spools instead of the normal *(6 spool)* double row *(Fig.6.29 (left))*
  - The Mk2 Bigbaler twine box has slightly more space and will accommodate six spools of most twine brands, albeit after some 'minor modification' *(Fig.6.29 (right))*.

Fig.6.28 Max. twine spool diameter

Fig.6.29 Bigbaler twine boxes – Mk1/1a *(left)* and Mk2 *(right)*

Bigbaler Twine Routing

Whilst you may have developed a new, non-standard route for the twine to follow on your baler, **correct twine routing is very important.** Otherwise the twine tensioners can't provide an effective means of adjusting twine tension during baler operation.

The twine route is very different on the Mk1/1a and Mk2 Bigbalers. The Operator's Manual provides the necessary information *(see Section 13 for download details)*: the following is only a summary.

Mk1/1a Bigbaler

- Twine Box is on the baler's right-hand side *(Figs 6.29 (left) & 6.30 (left))*
- Adjustable twine tensioners on top of twine box & also on the needle frame *(immediately behind Needles - Fig.6.30)*

The twine path from the Twine Box to the Needles is long & tortuous, down the rear of the box & under the bale chamber, through enclosed sheet steel channels & ceramic guides. It reappears immediately behind the Needle Frame, passes through the *(additional)* needle-mounted Twine Tensioners *(Fig.6.30 (right))* and then along the channel on the underside of the Needle to the 'Eye'.

Fig.6.30 Bigbaler Mk1/1a *(adjustable)* plate-type twine tensioners – on top of twine box *(left)* & behind needles *(right)*

This complex twine path caused some in-service issues with Mk1/1a balers. Twine tension was difficult to control and the twine sometimes suffered from chaffing & consequent breakage.

In an attempt to address this problem, the position of the needle-mounted twine tensioners was revised on later Mk1a Bigbalers. Previously the twine had passed through the tensioner and then through an unprotected hole in the needle mounting plate *(on the underside of the needle frame) (Fig.6.31 (left))*. On later Mk1a balers the tensioner was mounted lower and the twine then passed through a ferruled hole before entering the channel on the underside of the needle *(Fig.6.31 (right))*.

Fig.6.31 Different twine tensioner mounting locations and twine routings used on Mk1 & Mk1a Bigbalers

- Mk1 *(left)* and Mk1a *(above)*

Mk2 Bigbaler

- Twine Box is on the baler's left-hand side *(see Fig.6.34))*
- Adjustable plate-type twine tensioners inside the twine box
- Spring arm-type tensioners/guides inside the twine box
- Disc-type tensioners mounted near the needle frame *(left-hand)* pivot *(see Fig.6.33)*
  ***(N.B.** These only operate during the tying cycle)*

The twine path of the Mk2 baler is much simpler & more easily accessible than the Mk1/1a.

Twine passes from the spools through adjustable plate-type tensioners and spring-arm tensioning guides before leaving the base of the twine box.

It then passes down the baler's left-hand side, through *(additional)* disc-type tensioners, and on to the Needle eyes via a series of chrome-plated twine guides located on the needle frame and the baler chassis, immediately below the needle eyes *(Fig.6.32)*. This revised routing was intended to overcome twine chaffing problems sometimes experienced on Mk1/1a machines due to twine running along the underside of the needles.

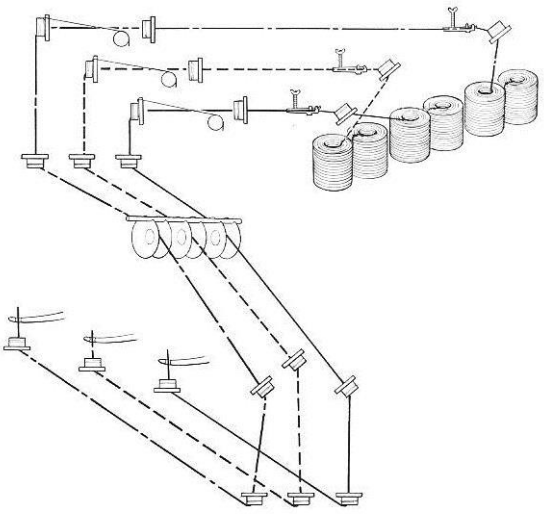


Fig.6.32 Mk2 Bigbaler twine path

(courtesy Howard Rotavator Co.)

Unlike Mk1/1a Bigbalers, Mk2 machines didn't use conventional ceramic twine guides *(see Fig.6.30)*. Instead, they employed a series of seven chromium-plated steel guides on each twine run from the twine box to the needle eye.

These metal twine guides function adequately, but were known to suffer from surface corrosion during Out-of-Season storage, even when the balers were relatively new. Such corrosion will dramatically increase twine tension and adversely affect knotter performance.

So, before each season, it is important to remove any rust with fine emery cloth & lightly smear the guides with oil.

Similarly, at the end of the baling season, the *(Mk2)* twine guides should be cleaned and treated with rust preventative.

Fig.6.33 Disc-type twine tensioners – Mk2 Bigbaler

Fig.6.34 Bigbaler Mk2 twine box featuring plate-type twine tensioners *(Yellow arrows)* and spring arm twine guides *(Blue arrow)*

- Foam pads inside door intended to prevent twine spools rotating during baler operation

Pre-Season Twine Routing

Before baling it's advisable to:

- **CHECK** that the twine is routed correctly:
  - Twine from the correct spool is fed to the correct Needle
  - Separate twine strands are not twisted around each other
- **CHECK** the *(ceramic & chrome-plated)* twine guides for possible wear grooves & incorrect positioning:
  - **If worn**, slacken & rotate the guide, so the twine runs on a fresh surface *(probably only possible for ceramic guides fitted to Mk1/1a balers)*
  - **Ensure** the guides are positioned correctly, to prevent the twine rubbing where it shouldn't
  - **Remove** any surface rust from *(Mk2 baler)* chrome-plated twine guides with fine emery cloth and smear with oil to prevent further corrosion.

Pre-Season Twine Tensioner Checking / Adjustment

Remember that twine tensioners are meant to be adjustable. Yes, it's tempting to 'leave-well-alone' if the baler is knotting OK, **BUT** twine tension is a very important setting for a Bigbaler: more so than for most other balers. It affects **both** knotter performance **and** bale shape & density.

So, expect to have to tweak twine tension as crop & weather conditions change, possibly during the course of each day *(see Section 8.3).* Because of this, check out the following items pre-season:

- **Plate-type Twine Tensioners** *(all Bigbalers)*
  - **CHECK** the adjustment screws aren't seized or broken/missing
  - **INSPECT** the tensioning plates for wear grooves and/or roughness. Rebuild to the original *(smooth)* profile
- **Disc-type Twine Tensioners** *(only Mk2 Bigbalers)*
  - These should only operate when the Needle Frame moves forward *(during the tying cycle)* & be disengaged by a cam lever when the frame is in the 'at-rest' position *(see Fig.6.33)*
  - **CHECK** the tensioner engagement / disengagement mechanism works correctly
  - **CHECK** that the tensioner's components aren't seized or worn and that it operates correctly *(when it's meant to)*. See the Mk2 Bigbaler Operator's Manual for the correct settings.

Initial Twine Tension Setting

As advised *(see above & Section 8.3)*, you should expect to adjust twine tension to suit the crop & operating conditions. Most baler manufacturers normally specify a 'starting point' twine tension value from which to make adjustments to suit local conditions. Interestingly, Howard initially did this, but then removed the guidance from later Operator's Manuals: but technical service bulletins to dealers continued to mention it.

As a starting point, the *(tension)* force required to pull the twine up through the needle eye & into the bale chamber should be approx. 15 lbs (~7 kg). This can easily be measured with a spring balance. ***(N.B. Ensure the (Mk2) disc-type twine tensioners are disengaged during this measurement)***.

6.6 Tailgate and Bale Ejection

Check that everything works properly and isn't excessively worn or broken, **BUT**

- If the Tailgate is raised, **ALWAYS** support it safely, either with the strut provided in the baler's rear frame *(see Figs 4.5 & 4.6)* or with a suitable steel or wooden prop

- **Tailgate Catch Plates & Release Mechanism**
  - **CHECK** that these release properly when the knotters are tripped. They should release as the needle frame returns to its 'at-rest' position at the end of the tying cycle. If not, refer to the Operator's Manual for the correct adjustment procedure

- **Tailgate (Catch) Indicators**
  - **CHECK** that these indicators operate properly & correctly show the 'Latched / Closed' or 'Unlatched / Open' positions of the tailgate catch plates *(Fig.6.35)*.

    If the baler is operated with only one side latched, the tailgate will be twisted & damaged.

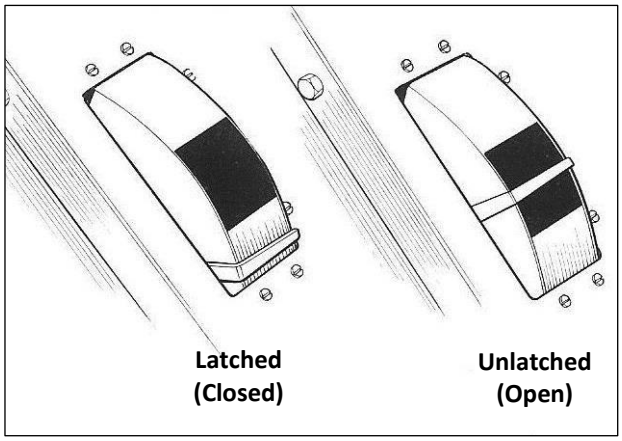


Fig.6.35 Tailgate *(catch)* indicators

(courtesy Howard Rotavator Co.)

- **Inner Tailgate**
  - **CHECK** that this pivots freely and that the return spring(s) are correctly tensioned

- **(Main) Tailgate**
  - **CHECK** that this is structurally-sound & free from cracks or damage, particularly at the top corners of the hinge arms & near the catch/release 'pegs' *(see Fig.5.20)*
  - **Also check** the rear structural members of the bale chamber, especially near the tailgate catches
  - **CHECK** that the tailgate counterbalance springs are adequately tensioned to cushion the impact of the closing tailgate on the baler rear frame:
    - **CONSIDER** renewing a 'tired' spring or modifying the tailgate spring post *(see Section 5.5)*
    - **ALWAYS** release the tension from the tailgate spring during out-of-season storage, to prolong its useful life. Either raise the tailgate & temporarily remove the spring **or** simply prop the tailgate open
  - If the (hydraulic) bale density indicator is present, check the pipework *(which can become brittle & fail)* and renew the *(brake)* fluid every few years. It's far cheaper than renewing a master cylinder which has become corroded & pitted internally due to moisture being absorbed by the fluid!

7 Other Preparation Before Baling

7.1 Tractor – Selection and Preparation

Tractor Power

You don't need a big tractor to power a Howard Bigbaler - ~60-70 hp is fine

DON'T use a big tractor on a Bigbaler:

- 65 – 90 *(engine)* hp is ideal: 100 hp maximum
- The baler's driveline isn't designed to handle any more & it's now ~50 years-old
- You need to be able to judge the baler's (p.t.o.) power demand on the tractor, to know when the bale is nearing completion. This is much more difficult with a higher-powered tractor up-front
- Adequate tractor ground clearance & track width are much more important than engine power.

Howard originally recommended 55 – 75 *(engine)* hp and later stretched this to 65 – 90 *(engine)* hp for the *(strengthened)* Mk2 Bigbaler, **but** don't be tempted to exceed this.

Bigbalers are not lightweight machines *(~2½ - 3 tonnes empty)*, so they require power to pull them around, particularly on sloping ground. **However,** unlike in their original application, when baling thatching straw, the baler is travelling at a lower forward speed: so big power isn't required.

Tractor Wheel Track (width) Setting

- As wide as possible!
- Set both front & rear wheels to a wide wheel track setting. A minimum of 5 feet (~1.5 m) **between** the tyre inner sidewalls: preferably more! *(Fig.7.1)*
- Remember the Bigbaler's windrow needs to be 5 feet (~1.5 m) wide and the tractor will need some sideways leeway to manoeuvre whilst baling, without running on the sheaves *(see Fig.7.5)*
- If necessary, **CONSIDER** fitting narrower tyres to the tractor **IF** it will increase the effective gap between them.

Fig.7.1 Set the tractor's wheel track to a wide setting *(at least 5 ft (1.5 m) between the tyres)*

Fig.7.2 Steel 'belly plate' fitted under the tractor's drawbar/pick-up hitch assembly

Tractor Ground Clearance

- The more the better, **BUT** not if it means using a bigger tractor with too much engine power!
  - If there's a choice, choose the tractor with 'tall' tyres
- Unless the tractor has really good ground clearance, **consider** fitting a 'belly plate' or a small tarpaulin to the underside of the tractor's gearbox/rear axle *(Fig.7.2)*, to prevent the sheaves catching on low-hanging components: particularly the drawbar / pick-up hitch assembly.

7.2 Crop Windrow/Swath – Preparation

It may seem to be a simple task, but careful windrow / swath preparation really pays dividends when using a Bigbaler to bale thatching straw. The nature of the windrow will affect:

- The speed & efficiency of baling
- Bale shape & resilience during subsequent handling

When preparing a windrow of sheaves for a Bigbaler:

- Form a **straight and quite dense** swath of 'square' cross-section *(Fig.7.4 (left))*
- Where possible, avoid making windrows along or across sprayer tramlines
- **Lay the sheaves cross-wise, Head-to-Tail.** There should be no appreciable gaps between them *(Figs 7.3 & 7.5)*
- **Windrow width should be 5 feet (~1.5 m)** *(Fig.7.3)* - the same as the baler's pick-up reel, throat & bale chamber
  - **IF** the sheaves are too short, widen the swath by pulling the **Butt Ends** out slightly
  - If the windrow width isn't correct, bale shape will be poor *(side-to-side)*, the outer strings are likely to be slack and/or misplaced, and knotting may be problematic.

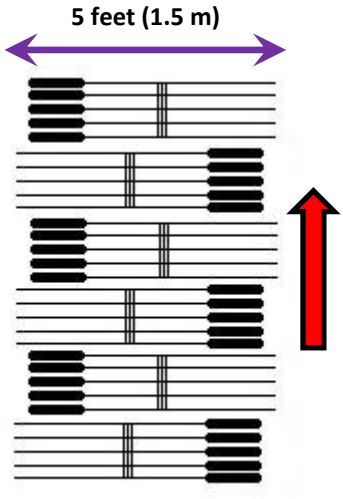


Fig.7.3 Recommended Bigbaler windrow/swath layout

- If the windrow is formed of groups of sheaves with gaps between them *(Fig.7.4 (right))*, crop flow into the baler will be repeatedly interrupted & the sheaves at the front of the bale chamber will sustain more damage from the packing plate than is necessary to form a stable bale
    - To avoid this, try to form a dense & continuous windrow *(Fig.7.4 (left))* **and** adjust tractor forward speed to keep the flow of crop into the baler steady & consistent.

Fig.7.4 Windrows prepared for baling – Good, dense windrow *(left)* and poor, gappy windrow *(right)*

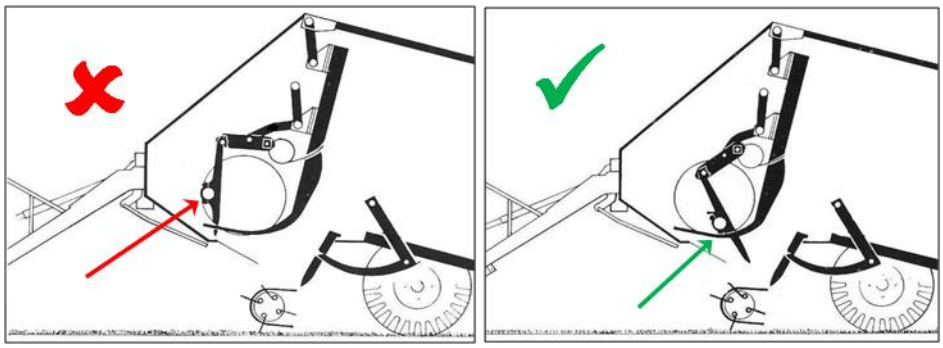
Fig.7.5 Tractor straddling well-formed windrow during baling

8 Bigbaler In-Field Operation

Fig.8.1 Mk1a Bigbaler baling thatching straw

Machine Safety

- **OBTAIN**, read & make sure you understand the baler's Operator's Manual **and** the Safety Warnings provided by it *(see Section 13 for download details)*
- **NEVER** approach the baler when it is under power / in motion
- **ALWAYS follow the SAFE STOP procedure:** Before leaving the tractor cab to make any repairs or adjustments:
  - **Disengage** the tractor power take-off (p.t.o.)
  - **Apply** the parking brake
  - **Stop** the tractor engine
- **ALWAYS** ensure the baler's Packing Fingers are at *(lowest)* **'Bottom Dead Centre'** position **and** the Packing Plate is fully forward **BEFORE** climbing onto or into the baler *(see below & Fig.5.1)*
- **ALWAYS** keep all safety guards in place **and** in good condition
- **BEWARE** of the unique risks the Bigbaler poses to the Operator **and** Bystanders:
  - Exercise care when manoeuvring the baler in-field – Especially when reversing
  - **Keep Bystanders away** from the machine when it's in operation – **Particularly the tailgate**.



(UNSAFE) (SAFE)

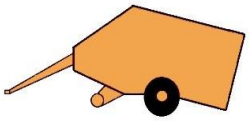
8.1 Before You Start

Before starting to bale, keep the following points in mind. If you follow them, it will all work better!

- **NEVER** turn a corner with the PTO engaged – **Only ever drive in a straight line** or *(if you have to)* follow a gentle curve. Anything else will give the p.t.o. shaft & driveline a very hard time
  - This is why the windrows should be as straight as possible *(see Section 7.2)*
- Operate the Bigbaler with consideration
  - **DON'T** use a tractor of over 100 hp. 65 – 90 *(engine)* hp is ideal *(see Section 7.1)*
  - **UNLESS** the Bale Density Indicator is working, **DON'T** drive with the cab rear window shut
  - ➢ Instead, **LISTEN** to the tractor & baler during operation – You will be able to judge its loading level & the point when the bale density starts to increase *(as the bale nears completion).*
- **DON'T** run the baler at 540 p.t.o. rpm when baling *(see Section 5.1)*
  - **Use approx. 330 – 375 p.t.o. rpm** *(approx. ⅔ of standard p.t.o. speed)*
  - **CHECK the baler's speed** – Count the number of Packing Plate strokes in 30 secs
  - **AIM for approx. 20 – 22 strokes per 30 secs** *(~40 - 45 strokes/min)*
  - **BUT** increase p.t.o. speed ***(to ~540 rpm)*** before tripping the knotters / during the tying cycle
- **DON'T** set the Pick-up Reel any lower than is necessary to pick up the sheaves effectively
  - **Set** the pick-up depth wheels to keep the tines at least 2 ins (5 cm) above ground
  - **Remember** that you're baling, **not** harrowing **and** that balers don't like eating stones
- **USE** good quality '8600' grade polypropylene twine *(8600 feet per 2 spool pack - see Section 6.5).*

8.2 Making a Bale

Click on the Baler icon or scan the QR code for video of Bigbaler operation



When Baling

- Keep a consistent & relatively rapid feed of sheaves into the baler
  - Too slow a feed will actually increase crop damage rather than reduce it. The 'new' sheaves entering the bale chamber will receive more 'blows' from the Packing Plate than necessary
- Don't overload the Pick-up Reel with sheaves
  - **BUT** do use a sufficiently high forward speed & a sufficient crop intake rate to keep the area 'busy' *(Fig.8.2)*. Sheaves need to be up in the 'throat', ready to be passed into the baler
  - Some users recommend trying to have one sheaf being lifted from the windrow, just as the previous one transfers from the top of the Pick-up Reel to the bottom of the baler's 'throat' / Packing Fingers *(Fig.8.3 (left))*
- **ENSURE** the windguard keeps pressure on the sheaves as they pass over the pick-up reel *(see Section 5.2)*. It will produce a more even feed of crop into the baler & increase overall output.

Fig.8.2 Mk1a Bigbaler baling thatching straw – Pick-up reel & windguard operation

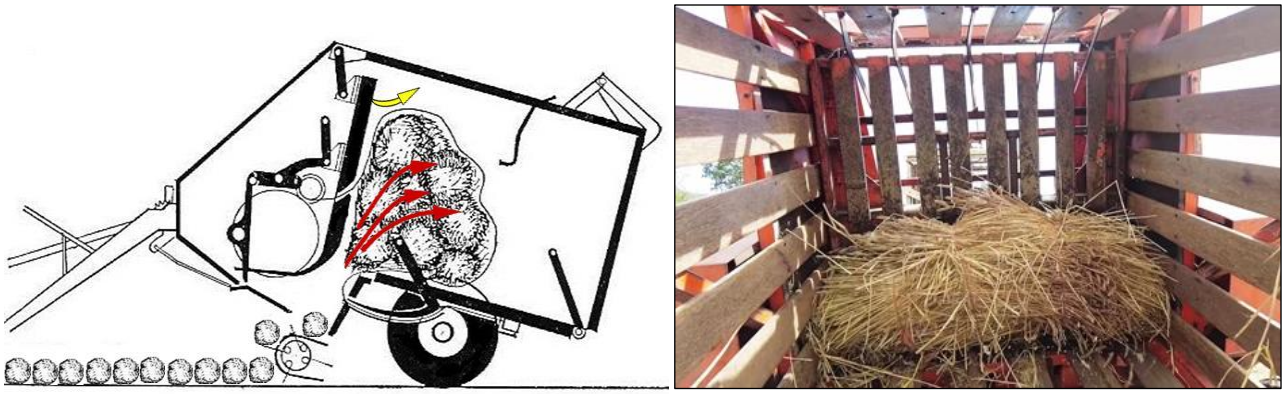


Fig.8.3 Bigbaler - Early stages of bale formation – Cross-sectional view *(left)* & inside bale chamber *(right)*, viewed from rear

The early stages of bale formation *(Fig.8.3)* are critical & require particular care:

- Even *(left – right)* crop feed into the Bale Chamber is essential during the first ¼ - ⅓ of bale formation, to get the twines positioned correctly around the rear-end of the bale *(Fig.8.3 (right))*
- **ENSURE** that the first few *(6 – 12)* sheaves are pushed back evenly *(left - right)* inside the Bale Chamber, so that they carry the *(three)* strands of twine from the Knotters, straight back towards the Tailgate. *(This can be viewed from the tractor seat through the slots in the Packing Plate)*
  - If the twines appear to be going towards one side of the Bale Chamber, immediately steer the tractor to feed more material into that side of the Pick-up Reel & Bale Chamber, to build-up that side of the bale & force the twines back straight again
- Once the bale is over half-formed, this is less of an issue, but crop feed (side-to-side) should still be monitored and adjusted to ensure the twines rise straight up the front of the bale from the Knotters *(the twines can be seen through the slots in the Packing Plate)*
  - If windrow width & shape is correct *(wide & square)*, these problems may well not arise.

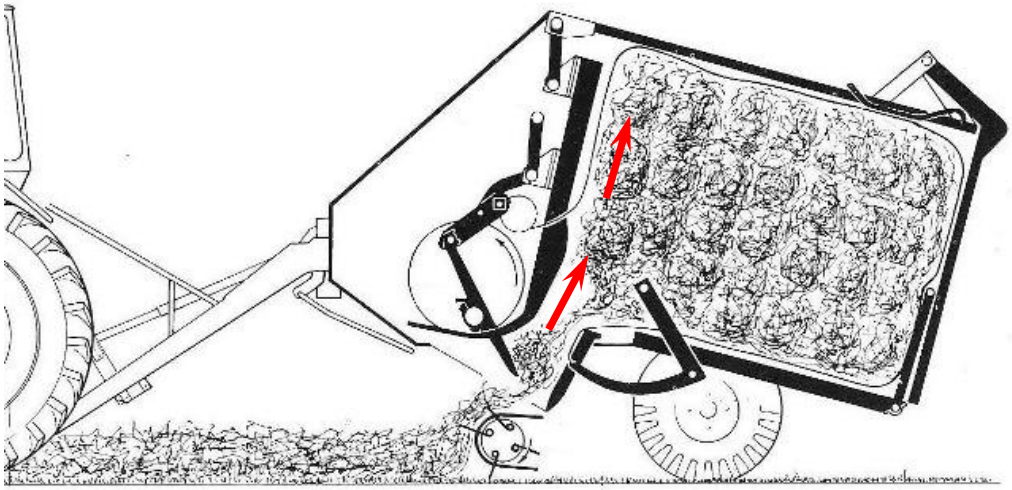


Fig.8.4 Bigbaler – Bale nearing completion

(courtesy Howard Rotavator Co.)

As the bale nears completion *(Fig.8.4)*, its density increases and the load on the baler & tractor will increase:

- **TRY** to feed the last few sheaves up to fill the front, top corner of the bale *(Fig.8.4 – Red arrows)*
  - This may or may not be possible **– DON'T try too hard** – You'll cause more damage to the last few sheaves & also risk overloading the baler
  - **DON'T** attempt to overfill the baler - **Remember** it is over 50 years old!
- When the baler is full, bring the tractor to a halt, **BUT keep the p.t.o. running**
- **BEFORE** tripping the Knotters**, WAIT** until all the remaining sheaves have been moved from the Pick-up Reel & Throat, and shifted up into the Bale Chamber
  - **NEVER trip the Knotters when there is still crop in the Pick-up or in the Baler's 'Throat'**
- **INCREASE** the tractor p.t.o. speed & then pull the cord to 'trip' the Knotters. The tailgate should unlatch automatically at the end of the tying cycle
  - **Pull and hold** the trip cord until the Knotter Shaft / Stack starts to rotate – **Then release the cord immediately**
- Once the tying cycle is complete, don't hang around! Let the p.t.o. speed drop back *to 'baling speed'* and start moving again to get more crop into the baler, **BUT** before you do **MAKE SURE THAT:**
  - All the knots have been stripped from the Bill Hooks
  - The Knotter Stack has returned to its correct 'at-rest' position *(the Twine Finger Cam Rollers are resting on the top **or** just in front of the top of their operating cams – see Fig.6.27)*
  - The Tailgate has unlatched properly *(look at the Catch Indicators – see Fig.6.35)* – This is rarely a problem, but it's very easy to check. If something is amiss, **follow the Safe Stop Procedure,** get out and investigate
- The Tailgate will close once the bale has been ejected. Make sure it closes properly & that both Tailgate Catches are engaged *(again, check the Catch Indicators – see Fig.6.35)*.

8.3 Operating Hints and Tips

Take the following precautions when using a Bigbaler, even when everything appears to be working just fine. Taking these steps will help ensure that the baler continues to operate reliably:

- Keep the area around the Knotters and Twine Fingers clean – Expect to remove twine offcuts & crop debris from the area a number of times each day. ***(N.B. Ensure the tractor engine is stopped & the Packer Fingers are in their lowest ('SAFE') position before doing so*** *(see Fig.5.1)**)***
    - Deering-type knotters produce a ~2 cm (¾ ins) twine offcut during each tying cycle. Unless removed regularly, these will build up & restrict Twine Finger movement, leading to knotting problems.
- **Expect to adjust the Twine Tension** for different crop conditions
    - Higher tension with drier crops and/or operating conditions *(e.g. during a hot afternoon)*
    - Lower tension with damper crops and/or operating conditions *(e.g. in the beginning & towards the end of the day)*
    - Approx. 15 lbs (~7 kg) force to pull twine through the Needle eye is a good starting point.
- Twine Tension will also affect the shape of the bale top, rear corner. Bale shape in this area is never particularly special, **BUT:**
    - **Insufficient twine tension** will cause the rear, top corner to be particularly soft, particularly as the Roof Hooks will have been removed or disabled *(see Figs 5.15 & 5.16)*
    - **Excessive twine tension** may cause the twine to be pulled out of the *(Knotter)* Twine Retainer Discs or even break the twine.
- **Don't forget** that Twine Tension is adjusted at two locations
    - At the Twine Box *(on both Mk1/1a & Mk2 balers – see Figs 6.30 & 6.34)*, but also
    - On the Needles *(Mk1/1a balers – see Fig. 6.30)* or on the Disc-type Tensioners *(Mk2 balers – see Fig.6.33).*
- **Remember** that Twine Tension can also be affected by restrictions & unintentional rubbing along the twine route *(particularly on Mk1 machines)*, so always check for this
- **IF a Knotter Drive Shearbolt fails, NEVER** re-engage drive to the machine *(following shearbolt replacement)* until all crop material has been removed from the baler's Pick-up Reel & 'Throat' area **AND** you have made sure that the Needles are in the 'retracted' / 'at-rest' position
    - If necessary, disconnect the Needle Connecting Rods *(see Fig.6.23)*, retract the Needles manually & tie the Needle Frame up, out of the way *(to the baler chassis)* until the Knotters have been returned to their 'at-rest' position
    - Wherever possible, **always turn the baler through a complete tying cycle by hand prior to re-engaging the tractor p.t.o. and recommencing baling.** This can save a lot of heartache!
- **ENSURE** the twine knives are kept sharp **and** that the Stripper Arms rub *(lightly)* across the heels of the Bill Hooks *(see Fig.6.10)*
- **CHECK every now & then** *(following a tying cycle)* that the Knotter Brake Pawl returns to the 3rd *(rearmost)* notch in the Knotter Brake Disc *(see Fig.6.24)*.

9 Bigbaler Troubleshooting and Fault-Finding

Introduction

This section of the Guide indicates certain parts of the Bigbaler which should be checked if the machine doesn't perform in-field as it should. It then goes on to review areas of the Bigbaler which are known to wear and/or exhibit weakness in-service and which should be monitored & addressed if necessary *(see recommendations given in Section 6).*

Once again, these suggestions are intended to compliment the information provided in the Bigbaler Operator Instruction Manual and **not** be a substitute for it. **Please always obtain and read the Instruction Manual for your particular baler** *(see Section 13 for download details).*

The Operator's Manuals include a useful fault-finding list, the Mk2 Bigbaler version of which is reproduced here for your convenience *(see Figs 9.1, 9.2 & 9.3)*. **However**, note that certain of the recommended solutions may not be applicable to Bigbalers which have been modified for use in thatching straw *(e.g. Roof Hooks removed)*.

9.1 In-Field Fault-Finding

9.1.1 Knotters

Every baler operator's worst fear! Surely if the baler stops tying in the field, it must be a fault with the Knotters? … Yes, probably, but are you really sure? It may be a different *(but related)* problem, so **always look carefully and think** before jumping to conclusions.

- **Before doing anything else, check the twine supply to the Knotters** *(see Section 6.5)*
  - Is the twine quality OK?
  - Is the twine tension to each knotter correct **and** similar to the others?
    - The twine will cut wear grooves in the Twine Guides, the Needle Eyes, the Packing Plate & even where it passes over the front edge of the Bale Chamber *(top of the baler's 'throat').*
    - Wear grooves will increase twine tension, eventually restrict twine movement and *(at worst)* abrade the twine & cause it to break once the bale is discharged from the baler
    - With this in mind, have you got a 'Twine (mis) Tying' issue **or** a 'Twine Breakage' problem? *(see Fig.9.3)*

Important questions to ask yourself include:

- **Is it a problem with just one Knotter or all three Units?**
  - If it's just one Knotter; focus on that Unit, its Twine Finger, its Needle **and** the twine supply *(and twine tension)* to it:
    - **Look closely** *(challenging with a Bigbaler!)*. Is there anything which looks or feels different to the other two knotters & their related components?
  - If all three Knotters are misbehaving, what things are common to them all? The problem may well lie with the:
    - **Knotter Drive Mechanism** and/or the **Trip Mechanism** *(see Sections 6.4.1 & 6.4.7)*
    - **Twine supply** *(twine tension and/or twine quality) (see Section 6.5).*

If it definitely seems to be an individual Knotter issue, try to identify your problem by comparing your mis-tied or broken string with the numbered diagrams in Fig.9.3 *(the diagram numbers correspond to the numbers in the Fault-finding List(s))*.

Possible causes of Bigbaler tying issues include:

- **Incorrect Twine Retainer Disc Timing** *(see Section 6.4.3 & Fig.6.11)***:** Check & adjust if necessary
    - Disc timing can slip if the worm gear isn't kept tight on the tapered shaft
- **Blunt Twine Knife:** An old favourite but very easily sorted
    - Remove the stripper arm & sharpen the Knife Blade
    - Remember to check that the Twine Knife doesn't touch the Bill Hook during the tying cycle *(see Fig.6.9)*
- **Stripper Arm not rubbing on heel of Bill Hook** *(see Section 6.4.3, Fig.6.10 & Table 3)***:**
    - Knot stays on the Bill Hook at end of tying cycle. 'Adjust' stripper arm accordingly
- **Incorrect Twine Placement by Needle** *(see Section 6.4.5)***:** Check & adjust Needle(s)
- **Incorrect Twine Finger operation** *(see Section 6.4.4)***;**
    - Remove any accumulated debris & twine offcuts, check for free movement & adjust travel if necessary
    - **Ensure twine routing is correct**
- **Incorrect Bill Hook operation** *(see Section 6.4.3)***:** Not a common problem **unless the**:
    - Bill Hook is worn, damaged or its surface is rough/pitted
    - Drive pinion is worn. **Remember,** knotter components may drive *(by friction)* when not loaded, **BUT** a pinion drive pin may in fact be broken
    - Bill Hook jaw/tongue pressure is incorrect. **Adjust this very carefully** – ¼ turn max at a time - It is very sensitive!
- **Incorrect Twine Retainer *(Clamping)* Pressure** *(see Table 3)***:** Another very sensitive adjustment!
    - **If Insufficient,** the twine may be pulled from the knotters during bale formation, **BUT** excessive twine tension or restriction *(e.g. top bar not removed from the Inner Tailgate)* can cause similar problems. If a knot is tied, its 'tails' will be long & one may be looped
    - **If Excessive,** the knot's 'tails' will be short. Can overload & damage the Bill Hook and other components. **Adjust this very carefully!**
- **Damaged/Cracked Knotter Frame** *(see Fig.6.12)***:** Perhaps not visible or immediately obvious, but it can allow the knotter components to move slightly when under load & cause annoying, intermittent malfunctions
- **Packing Fingers Rub on Twine:** When the chamber is empty *(at the start of each bale)*, the Packing Finger sides rub on & can weaken the twine. This is why baling must recommence promptly after tying. The Packing Plate can also abrade the twine if the bale chamber isn't filled evenly *(side-to-side)*.

Fault	Possible Cause	Remedy
1. Clutch slips.	Clutch not adjusted.	Check and reset clutch.
	Too much material in bale chamber.	Trip at lower pressure reading.
	Uneven windrow creates too large a bundle for packing fingers to handle, especially towards completion of bale.	Drive more slowly. Spread windrow more evenly.
2. Failure to pick up material cleanly.	Pick up reel too high.	Fit optional links to pick up reel lift rods.
	Pick up tines bent or broken.	Replace broken and bent pick up tines.
	Ground speed too fast.	Slow down.
3. Twine does not run freely.	Inner gate top tube forcing twine against Bigbale.	Remove inner gate top tube.
4. Pressure indicator fails.	No fluid in header tank.	Fill header tank with brake fluid until level with top of bracket and bleed system.
	Tube punctured or broken.	Replace tubing.
	Bad pipe connections.	Tighten pipe connections.
5. Knotter drive mechanism "chatters".	Knotter brake tension too great.	Reduce tension.
	Knotter release lever incorrectly set.	Re-position knotter release lever.
6. Knotter trip fails.	Trip cord safety loop in safety hook.	Remove safety loop from safety hook.
	Trip cord broken.	Replace.
	Trip cord stretched.	Shorten or replace.
	Trip arm spring broken.	Replace spring.
	Knotter brake tension too loose.	Increase tension.
7. Knotters tripped but fail to return.	Drive sprocket worn.	Replace sprocket and if necessary, the chain.
	Knotter drive chain broken.	Repair chain or replace.
	Knotter drive mechanism broken.	Replace mechanism.
	Knotter drive bolt sheared.	See No. 8.
8. Knotter drive shear bolt broken.	Dirty knotter.	Clean knotters.
	Improper adjustment of knotter brake.	Adjust brake.
	Needle maladjusted.	Check needle setting.
	Incorrect setting of knife arm.	Check knife arm setting.
9. Knotter crank arms and connecting rods not in line.	Knotters operating too slowly and lack inertia to complete knotting cycle.	Knot with tractor pto speed at 540 rpm.
	Knotter release lever incorrectly set.	Re-set trip plate.
	Knotter brake too tight.	Slacken off knotter brake.
10. Needle breakage.	Solid objects in needle slots.	Remove objects and clean slots.
	Maladjustment of needle.	Check needle setting.
	Needle timing out with packing fingers.	Time needle movement to fingers.
	Worn knotter trip mechanism.	Replace knotter trip mechanism.
11. Disc retainer notches not holding twine although tension is correct.	Twine is held by one half of the disc retainer notches.	Check needle position in knotter assembly and twine fingers.

Fig.9.1 Bigbaler (Mk2) Fault-finding List

(courtesy Howard Rotavator Co.)

Fault	Possible Cause	Remedy
12. Knots hanging on bill hook. (see fault 14 also)	Too much tension on bill hook cam.	Loosen bill hook cam adjusting nut.
	Rough bill hook.	Replace bill hook.
	Twine tension to high	Reduce twine tension.
13. Disc retainer does not rotate.	Roll pin in worm pinion sheared.	Replace pin.
	Shaft in disc retainer turns in hub.	Replace disc retainer assembly.
	Worm pinion slips on shaft.	Tighten locknut after checking position of disc retainer.
14. Twine chafing on packing plate.	Twine tension too high.	Slacken twine tension. Remove inner gate top tube.
	Twine retainer clamp loose.	Tighten.
	Retainer clamp blocked with rubbish.	Remove rubbish.
	Twine finger not moving twine.	Check twine finger mechanism.
15. Twine tears. (see fault 13 also)	Knife arm stripping groove does not contact back of bill hook.	Replace knife arm
	Dull twine knife.	Sharpen twine knife.
16. Twine frayed or broken approx. ½ inch (12.5 mm) back from knot.	Stripping groove impedes movement of bill hook.	Replace or file knife arm
	Dull knife.	Sharpen or replace blade.
17. Top twine frayed with full knot on bottom twine which sometimes remains on the bill hook.	Twine not central and rubbing on packing plate.	Fill chamber correctly.
	Bigbale not completed soon enough.	Increase forward speed. Turn two swaths into one.
18. Both ends frayed and no knot formed.	Twine retainer tension too great.	Reduce twine retainer tension.
	Twine retainer position incorrect.	Re-set position of twine retainer notch.
19. Both ends wrinkled and no knot formed.	Twine retainer too loose.	Tighten.
	Twine retainer clamp blocked with rubbish.	Remove rubbish.
20. Twine cut off or torn but no knot made.	Too much tension on twine tightener.	Loosen twine retainer clamp.
	Rough edges on twine retainer or disc retainer notches.	Remove sharp or ragged edges.
	Twine retainer clamp spring too loose and twine pulls out of disc retainer notches when bill hook turns.	Tighten twine retainer clamp
21. Twine pulls out of retainer.	Twine retainer too loose.	Tighten twine retainer clamp.
	Twine tension too great.	Slacken tension.
22. One end of twine longer than the other. Loop in one end of twine.	Dull twine knife.	Sharpen or replace blade.
	Insufficient tension on bill hook jaw.	Tighten bill hook tension spring.
23. Knot has one long end which is sometimes looped back into knot.	Twine retainer clamp too loose .	Tighten twine retainer clamp.
24. Knot at one end only, other end pulled through.	Twine finger incorrectly set. The twine brought up by the needle does not go over knotter bill hook jaw.	Re-set twine finger.
25. Knot only tied at one end.	Distance between disc retainers and needle too great.	Reset needle.
	Knotter bill hook jaw twisted.	Replace knotter bill hook.
	Knotter bill hook jaw fails to open wide enough due to roller having worn a groove in bill hook cam.	Fit new parts
	Distorted twine fingers.	Replace twine fingers.
26. Twine broken above good knot.	Too much material in Bigbale making it too dense.	Knot off sooner.

Fig.9.2 Bigbaler (Mk2) Fault-finding List *(continued)*

(courtesy Howard Rotavator Co.)

Fault	Possible Cause	Remedy
27. Knots too loose.	Bill hook cam too loose.	Tighten bill hook jaw cam plate spring.
28. Knots torn and ragged with short ends.	Twine retainer clamp too tight.	Slacken twine retainer clamp.
29. Knots pulling apart.	Bill hook tension too slack.	Tighten bill hook cam adjusting nut.
30. Tailgate does not open.	Trip arm roller worn.	Replace roller of tailgate opening mechanism.
	Bell crank worn.	Replace bell crank.
	Trip arm spring broken.	Replace spring.
	Connecting rod broken.	Replace rod.
31. Tailgate does not close.	Gate catch in closed position.	Trip open by hand.
	Tailgate balance spring too strong.	Position in a lower hole on tailgate arm. Adjust tensioner
	Tailgate twisted.	Straighten.
32. Bale shape irregular. Bale too loose.	Insufficient material in bale chamber when tripped.	Trip at a higher density.
33. Front face has hollows or step.	Knotters tripped too early or too late.	Trip knotters when bundles reach top of packing plate.
34. Back face slopes.	Bad filling at start.	Ensure full, even feed across reel.
	Roof hooks too slack.	Tighten roof hook springs.
35. Twine lies to one side.	Bad filling at start of bale.	Ensure full, even feed across reel.
36. Front of bale more dense than back.	Material not held back by floor dog teeth.	Raise front position of dog teeth.
37. Tailgate indicator fails.	Rod broken.	Replace rod.
	Pivots binding.	Oil pivots.
38. Material falling out of chamber before tailgate closes.	Roof hook tension too slack.	Tighten roof hook springs.

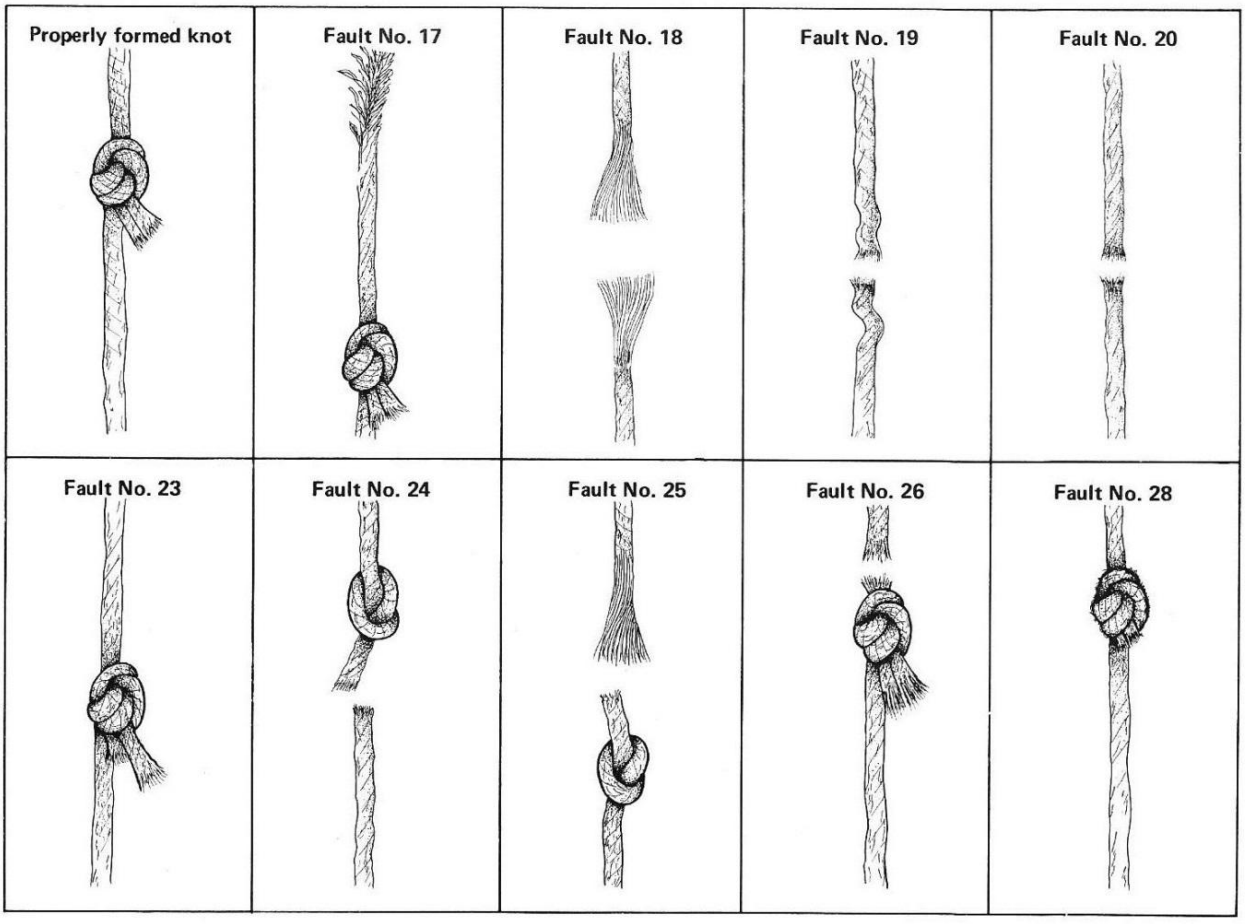


Fig.9.3 Bigbaler (Mk2) Fault-finding List *(continued)*

(courtesy Howard Rotavator Co.)

9.1.2 Possible Faults in Other Areas

Other than the Bigbaler's knotter & related bale tying components, there are few other areas of the machine which are likely to give trouble in-field, **assuming** that the items outlined in Section 6 *(Bigbaler Pre-season Preparation & Setup)* were addressed before baling commenced.

Unfortunately, like most other agricultural harvesting machinery, balers may seem to be *'Lots of preparation & not so much Operation'*. However, on reflection, this may seem like a worthwhile price to pay for a painless & trouble-free baling season.

So, pass an occasional eye over the following Bigbaler components, just to avoid any nasty surprises when you least want them:

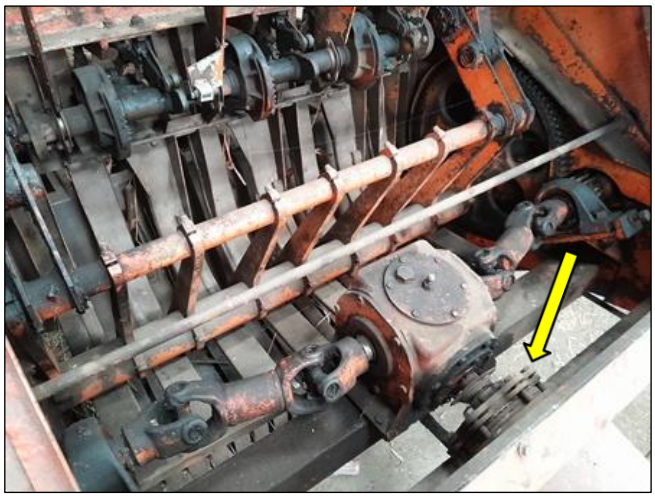


Fig.9.4 Bigbaler gearbox, output-shafts & main slip clutch *(arrowed)*

- These components need to do their job(s) properly

- **P.T.O. Shaft(s), Main Slip Clutch & Gearbox Output Shafts** *(Fig.9.4)*
    - A seized slip clutch is just waiting to cause damage to your Bigbaler. Don't give it the chance. It was put there for a reason. **BEFORE each season, check that it isn't seized and ENSURE it will work** *(see Section 6.1)*
    - Failure in any of the other driveshafts or their universal joints is likely to be both dramatic & potentially highly damaging to other *(difficult-to-replace)* baler components. **ENSURE** the driveshafts & joints are in good condition & are properly lubricated: even the sliding sections of the main p.t.o. shaft(s), which often get forgotten about.

- **Pick-up Reel Cam Track & Cam Rollers** *(see Section 6.2)*
    - These important components are rather 'out-of-sight & out-of-mind'. They wear, the rollers can seize due to lack of lubrication, & eventual failure is likely to be both dramatic & unwelcome
    - ***(Pre-season)* inspection/preventative maintenance is likely to be far better than an in-field breakdown. Ensure adequate lubrication during use.**

- **Pick-up Reel Drive** *(see Section 6.2)*
    - Again, hidden away in its chain case, it's a simple, cheap-to-replace component. **Check it out before it breaks or does damage.**

9.2 Bigbaler – Known Areas of Weakness

The following areas of the Bigbaler are known either to be weak / problematic or have been found to be susceptible to wear in-service. **Note:** this doesn't mean that they won't function properly in-service. It simply means that if they receive a bit more attention and some preventative maintenance, your Bigbaler is likely to be more reliable in-work. **Specific areas include:**

- **Single-Section P.T.O. driveline** ***(Mk1/1a Balers)*** *(see Sections 5.6 & 6.1)*
    - Prone to excessive vibration & wear. Replace it with a two-section shaft if at all possible
- **Knotter Drive Mechanism** ***(all models)*** *(see Section 6.4.1)*
    - Excessive wear in drive sprocket support bush causes wear in / damage to other knotter drive components. Monitor & replace bush *(see Fig.6.7)* as soon as wear is evident
- **Knotter Drive Cam** ***(all models)*** *(see Section 6.4.1)*
    - All appear to have been modified in-service *(by Howard dealer recall?)*. Thereafter it doesn't appear to give trouble, **BUT** it's important not to let wear / free-play develop in adjacent components
- **Knotter Shaft Drive Flange** ***(Mk1/1a Balers)*** *(see Section 6.4.1)*
    - Cracks originate from the drive flange internal keyway. Subsequent free-play in the knotter shaft drive can disrupt knotter timing
    - The right-hand drive flange appears to be more susceptible to cracking than the left-hand flange, probably due to slightly higher loading
    - This is a design / manufacturing fault, but can be repaired by welding.
- **Knotter Support Frame – Bottom bar** ***(all models)***
    - Has been found to distort in-service. The precise cause isn't known, whether due to seizure of the knotter shaft bearings *(see Section 6.4.2)* or accidental impact from the Packing Fingers during over-travel. In severe cases, can stress the Knotter Stack
    - Monitor and attempt to identify & address the cause.
- **Tailgate** ***(mainly Mk2 Balers)*** *(see Section 5.5)*
    - Insufficient/inadequate counterbalance spring effort to cushion tailgate impact when closing. Ultimately causes stress cracking in the tailgate frame
    - Consider extending the tailgate spring mounting post and/or installing an adjustable spring mounting, to increase the spring's *(counterbalance)* effort.
- **Bale Density Sensor / Indicator** ***(all models)*** *(see Section 5.5 & Table 4)*
    - Inevitable deterioration of cylinder seals and/or pipework over time. This system may not be regarded as particularly important, but it could be of real value: and be returned to operational condition at moderate cost
    - **Importantly,** use of the density sensor could really help to avoid unintentional overloading of the baler, particularly if it's used with a larger tractor and/or when operating in certain crop conditions. Avoiding causing accidental damage to an increasingly rare & hard-to-replace Bigbaler could be money very wisely spent.

10 Bigbaler Maintenance

10.1 Out-of-Season Maintenance


Fig.10.1 How not to store your Bigbaler over winter

Leaving a Bigbaler part-full of thatching straw at the end of the baling season provides a haven for vermin & a recipe for machine deterioration. So instead, do what you **should** do to any square baler **BEFORE** the autumn arrives:

- **Remove all debris & crop material:** Blow the baler down with an airline - **Don't wash it down!**
- **Inspect for worn/damaged parts:** This will avoid nasty surprises come next season
- **Protect against corrosion:**
  - Grease / lubricate the baler as recommended in the Operator's Manual *(see Section 13 for download details)*
  - Coat the Bill Hooks & *(metal)* Twine Guides with grease or rust preventative
  - Spray the rest of the machine (***EXCEPT*** *the Knotter Brake Disc)* with a 60:40 mix of diesel & *(clean-ish)* oil

    *(**N.B. NOT waste engine oil** – Old gearbox oil is ideal)*
- **Open the Tailgate *(to reduce spring tension)*:** Prop the tailgate open or disconnect the spring
- **Remove weight from the wheels:**
  - Jack the machine off the ground & support it on stout wooden blocks. It really will prolong the life of the *(old)* tyres
- **Store the baler undercover:**
  - Keep the machine dry. Ideally in a shed, but at least under a decent sheet.

Before next Season, find time to work through the **Pre-season Preparation & Setup** steps recommended in **Section 6 of this Guide**.

10.2 Servicing and Repairing Your Bigbaler

This Guide provides information to help a Bigbaler owner/operator to setup & operate their machine, and also to modify and maintain it, to get best performance when baling thatching straw.

Bigbaler operators require experience of agricultural machinery operation **and** a certain level of mechanical competence. Bigbalers are not simple machines: they are also becoming increasingly rare. Replacement parts are not readily available if something breaks *(see Section 11).* So, perhaps it might not be a wise move to let a well-meaning novice operate a Bigbaler. What could possibly go wrong? Do you really want a list??

Also, whilst most Bigbaler owners/users will be competent operators, some may not have the necessary mechanical skills or the available time, to implement all the recommendations given in this Guide. To service, maintain & modify a Bigbaler. So, in these instances, where do you go to for professional help?

Ideally you need the assistance of an agricultural engineering technician with component fitting/replacement, repair & possibly rebuilding skills **AND** also experience of conventional/square baler troubleshooting/repair. Someone with these skills, armed with this Guide, should have few problems.

However, such individuals are in demand and hourly charge rates may not be cheap.

Technicians from large, franchised agricultural machinery dealerships are unlikely to be familiar with Howard Bigbalers, **BUT** they probably will be familiar with modern, large square balers. This is a very good starting point.

Fig.10.2 What knowledge and skills are required to service & repair a Bigbaler?

A more experienced, independent service technician may well also have the necessary skills & knowledge. Alternatively, some mechanically-experienced Bigbaler owners may be prepared to undertake servicing & repair work for other growers, out-of-season.

11 Bigbaler Parts Availability

If you are operating a Bigbaler commercially *(i.e. not playing with one as a hobby)*, no matter how carefully you use & maintain it, sooner or later parts will wear & require repair or replacement. This is as certain as either death or taxation!

The Bigbaler is a rather unique, 'one-off' machine. Consequently, many of its parts were specially designed & made for it, either by the Howard Rotavator Co. or their sub-contractors.

Bigbaler production ended in late-1980 following closure of the Halesworth *(Suffolk)* factory. Bigbaler spares were transferred to Howard's Harleston *(Norfolk)* factory, but unfortunately Howard Rotavator Co. Ltd went into receivership in autumn 1985. The Harleston factory and the remaining Bigbaler spares were then acquired by Dowdeswell Engineering Co. Ltd and Dowdeswell (Norfolk) continued to supply Bigbaler spares from gradually diminishing stocks until it too went into receivership in 2001. Not a very ideal situation.

Fortunately, Howards used a number of *'off-the-shelf'* Original Equipment Manufacturer (OEM) components on the Bigbaler: parts which were also used on other manufacturers' machines *(e.g. p.t.o. driveline, pick-up reel & knotter parts)*. Because these parts were used on a much wider range *(and larger number)* of machines, there is still a replacement parts demand for some of them today.

So, thankfully, certain Bigbaler replacement parts can still be purchased 'over-the-counter' from aftermarket parts suppliers *(see Table 4 for more details)*. Additionally, Howards also kindly listed the OEM parts numbers for these components in the Bigbaler Parts Lists *(see Section 13)*, and these numbers can often be used to cross-reference replacement parts from suppliers today.

So, in the event of machine breakdown, the Bigbaler user is faced with the following options:

- **Purchase a Replacement Part**
  - Fine if one of the items listed in Table 4 *(i.e. certain p.t.o. driveline, pick-up reel & knotter parts)*
  - Parts **may** be expensive
- **Salvage Part from a Scrap Baler**
  - Scrap Bigbalers are becoming increasingly rare
  - If the part is worn or broken on your baler, it may well also be worn or about to fail on a scrap baler ☹
- **Repair the Original Part**
  - Repair may / may not be possible
  - Repair may be time consuming and/or costly.

Bigbaler Parts - Do's and Don'ts

- **DON'T** be in too much of a hurry to plunder an old Bigbaler for spare parts. Investigate availability of replacement parts first:
  - The old baler may be more valuable/useful to save & return to work in the future. **Remember**, they aren't making them anymore!
- **When buying replacement spares from aftermarket suppliers, try to source 'OEM'** ***(Original Equipment Manufacturer)*** **components** *(e.g. genuine Rasspe (Schumacher) knotter parts)* as opposed to spurious copies. These are often available from the same suppliers and, whilst more expensive, are likely to be of better quality.

Table 4 Howard Bigbaler – Replacement Parts availability

Component	Availability?	Comments	Potential Source(s)
P.T.O. Driveline & Gearbox	Yes - (P.T.O. driveline) No - (Gearbox)	• Standard *(BYPY or Walterscheid)* p.t.o. driveline components • **Ensure** replacement part is same spec. as original	• Most aftermarket parts suppliers (e.g. Kramp UK, Granit UK, Sparex)
Pick-up Reel	Yes - (certain parts) • Pick-up tines • Mk1 stripper bands • Cam rollers • Tine bar crank arms	• Mk1 baler used a standard Kemper pick-up reel • Also used on certain Kemper & Strautmann forage wagons • Mk1 pick-up tines will fit Mk2 baler	• Kramp UK (definitely) • Woodfields Baler Spares (possibly)
Packing Fingers & Drive Gear(s)	No	• Howard-manufactured components	-
Packing Plate	No – But …	• Howard-manufactured component but can be repaired	-
Knotter Drive Mechanism	No – But …	• Howard-manufactured components • Can be repaired / remanufactured	-
Knotter Brake Pads	No – But …	• Can easily be relined by local brake remanufacturing company	-
Knotters	Yes - (most parts) • Bill hooks • Knife arms & rollers • Drive pinions • Knotter frames	• Standard Rasspe knotter components • Original (Rasspe) part nos provided in Bigbaler Parts Lists • **Ensure** purchase of the correct, good-quality parts	• Kramp UK • Woodfields Baler Spares
Needles	No	• Repair of original part or bespoke re-manufacture probably the only options	-
Tailgate Spring	No – But ….	• Can probably be remanufactured • Need to know closed length, no. of coils, coil pitch/wire diameter & outside diameter	Various
Bale Density Sensor	Yes	• Lockheed *(AP Braking)* master cylinder *(Morris Minor?)* • Standard *(Bundenberg)* pressure gauge: 0 – 2000 psi *(0 – 140 bar)*	• eBay • Classic car parts suppliers

12 Sourcing Your Howard Bigbaler

This guide provides a host of useful information regarding how to setup and operate your Howard Bigbaler. Great! But what if you don't yet have a baler? Where can you obtain one from?

Well, as already discussed in Sections 2 and 4, less than 2000 Bigbalers were ever made and production ceased in ~1980. What's more, whilst a decent product in its day for its original intended purpose *(packaging of hay for barn drying)*, the Bigbaler was never held in particularly high esteem by some users. It wasn't the high-density square baler they wanted. Also, a significant number were exported overseas *(e.g. Australia, New Zealand & throughout Europe)* during the production period.

Rather it's only in subsequent years that the Bigbaler's suitability for low-damage packaging of thatching straw has been appreciated and demand has increased. This has resulted in forgotten machines being rescued from dusty barns across the country and much farther afield. Demand is such that some *(good condition)* machines are now being re-imported to the UK.

So, it is fair to conclude that today:

- Howard Bigbalers are relatively rare and sought-after machines
- Occasional machines may be sitting in dusty barns, having been retired by their original owners, **BUT** most machines will already be in the hands of thatching straw growers
- The opportunity to acquire a Bigbaler is more likely to arise when an existing *(thatching straw)* grower either retires or changes their crop harvesting/packaging system.

OK, so where should you search for such an elusive piece of farm machinery? Any of the following may prove fruitful:

- (UK) farm machinery sales/auctions, particularly in thatching straw growing areas *(i.e. South West, South, South East & East Anglia)*
- *(Internet-based)* secondhand farm machinery selling websites in other European countries *(e.g. Agriaffaires)*. **N.B.** Allow for transport & importation costs
- Thatching straw grower websites & social media pages *(i.e. NTSGA)*
- Farm machinery magazine classified ads *(e.g. Classic Tractor, Tractor & Machinery, Farmer's Guide, Farm Ads, Farm Machinery Locator, Wrights Farming Register)* – also available online
- Internet and social media selling sites *(e.g. eBay & Facebook/Meta Marketplace)*
- 'Word of Mouth' enquiries to existing thatching straw growers and farm machinery/baler enthusiasts.

I'm afraid the bottom line is that Howard Bigbalers don't appear for sale very often and when they do, they tend to be snapped-up fairly quickly. **However**, having said that:

- **DON'T** be rushed into buying a machine which is in poor condition, which you may later regret
- **ALWAYS** budget for what will almost certainly be a **considerable parts and labour cost** to bring any new purchase back up to reliable working order. You would expect to do the same for any other 45+ year-old piece of p.t.o.-driven farm machinery which has led an active working life. Don't expect a Bigbaler to be any different!

13 Bigbaler Operator Instruction Manuals and Parts Lists

The following Bigbaler Operator Instruction Manuals and Parts Lists are provided for your personal assistance. They may be downloaded without charge, **BUT they remain the copyrighted property of the Howard Rotavator Co. Ltd.**

On No Account May these Documents be Reproduced or Redistributed

To download an Operator's Manual or a Parts List, simply click on the relevant icon *(below)* or, alternatively, scan the adjacent QR code.

Mk1/1a Bigbaler

Mk2 Bigbaler

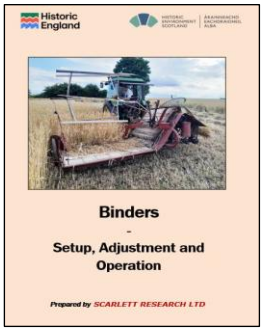
14 Thatching Straw Harvesting Machinery – Technical Guides

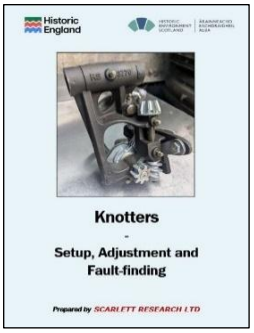
This publication is one of a series of technical guides prepared by Scarlett Research Ltd, on behalf of Historic England and Historic Environment Scotland. These guides are intended to illustrate machine adjustments, modifications & operating techniques which are likely to improve the efficiency & productivity of certain types of equipment when used for harvesting of cereal straw for thatching.

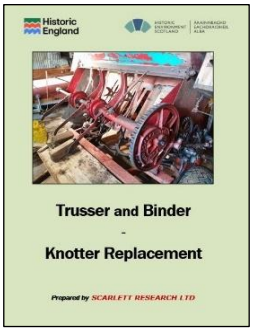
Technical Guides in this series include:

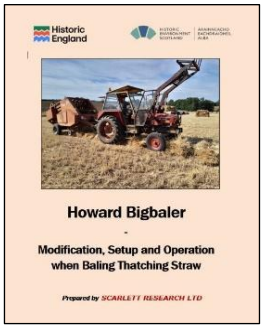
- **Binders – Setup, Adjustment & Operation**
- **Knotters – Setup, Adjustment & Fault-Finding**
- **Trusser and Binder – Knotter Replacement**
- **Howard Bigbaler - Modification, Setup & Operation when Baling Thatching Straw**

The guides may be downloaded by scanning the relevant QR code *(above)*, 'clicking' on the relevant image *(below)* or from the Historic England website.









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