Cane / Rod Puller

CONTENTS

#

#

LEFT BLANK

Description

The SG Controls Caterpillar Cane Puller is a dual-function unit, operating both to draw canes of glass up to 5 mm in diameter or, in certain configurations, as a start-up capstan for thinning fibre down to a diameter small enough to thread through the dies of a pressurised coating system and thence onto the tower's main capstan.

(drawings 380116A, 286845A, 287343A, 380936A, 286851A, 286852A & 286860A refer).

It comprises two opposed driven belts between which the cane or fibre is trapped and drawn downwards. Each belt runs over 3 pulleys, two idlers disposed one vertically above the other and a driven one situated behind them. Nominal belt contact length is 100 mm.

The unit's servomotor/gearbox assembly drives the left hand rear pulley via a tooth belt and bevel gearbox. Rotation drive is also transferred to the corresponding right hand rear pulley via a telescopic shaft and an identical bevel gear arrangement. Tension of the tooth belt may be adjusted by loosening the four clamping screws and adjusting the tensioning screw which moves the position of the bracket holding the drive pulley. When the required tension is reached the clamp screws should be locked off. Belt tension should not be excessive but should be sufficient to ensure positive engagement of the teeth when running with the belts both opened and closed.

Each group of 3 pulleys is mounted onto a carriage which moves them in and out of the tower centreline via a common rail system. Each carriage is connected to its own dedicated pneumatic ram which can force them apart for start up or when the cane puller is not in use and can force them together to trap the cane or fibre. The pneumatic ram controlling right hand belt assembly is intended to act at high pressure to hold it against a stop to become a fixed datum. The ram controlling the left hand belt assembly is a special low friction unit and driven by a precision regulator. It is this belt assembly that provides precise and adjustable control of the gripping force applied between the two belts.

A pair of PTFE guide rollers above the top pulleys and attached to the right hand carriage plate keeps the fibre/cane running in the middle region of the belt. The roller spindles can be moved along a slot in their bracket to adjust their spacing and guide position.

The unit is designed to operate as part of the tower's integrated control system (see software manual) but local controls are provided on a panel to the right for belt open / close.

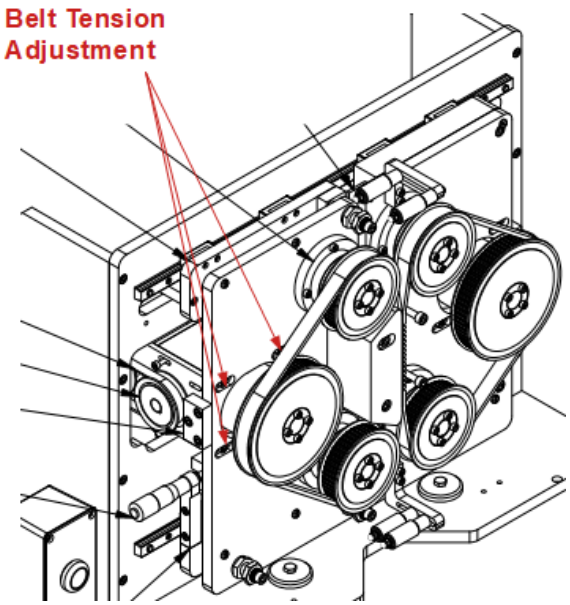
#

Operation

Belt Fitting / Removal and Tensioning

The inside surface of the belts is toothed and this meshes with matching teeth on the pulleys to retain them. To remove or fit the belts it is necessary to move the rear pulley in towards the other two as far as possible. This is done by slackening the 4 cap head screws around the rear pulley (two above and two below, recessed into slots) and turning the tensioning screw on the end face of the mounting plate (level with the pulley centreline) anticlockwise as far as it will go. Tensioning is done by winding the screw clockwise until the necessary tension is obtained and then retightening the 4 clamping screws.

Setting Travel Limits



The travel limit of each carriage is set by mean of adjustable stop screws attached to the top rear of each carriage plate. The position of the outer limit stops is not particularly critical, provided there is sufficient space between the belts for access during start-up. However the position of the inner stops is more important as this affects the position of the gripping point relative to the tower's centre line during operation and also determines whether or not the belts touch when the ram is closed. If the inner stops are set so the belts can press together fully when closed then cane gripping force is determined solely by the force applied by the ram. This can be modified by adjusting the pressure supplied to it by the precision regulator with digital display. The minimum force available is determined

by the lowest pressure that will still allow the ram to move without sticking.

Note that the pressure of the ram controlling the right hand carriage (that set by the non-digital regulator) should always be higher than that used for the ram controlling gripping force (that set by the digital regulator).

This end-stop configuration allows the unit also to function as a start-up capstan for fibre drawing without any changes to their settings. To ensure the position of the fibre/cane still aligns with the tower's fibre line, the stops need to be set to provide minimum free play when the ram is closed.

An alternative way of setting the inner limits is to set a gap between the belts that is less than the target cane diameter but far enough apart that the end stops are still reached when drawing is taken place. Assuming that ram pressure is then set sufficiently high, gripping force is determined by a combination of the gap setting and the elastic compliance of the belt.

Care needs to be taken to avoid cane slippage on one hand and reverting to ram force on the other. If the product diameter is varying significantly this approach is unlikely to be successful. An adjustable stop with Vernier gauge on the left hand side of the carriage is provided for control of the belt gap.

Alignment to Fibre Line

The face of the right hand belt arrangement shall be set so that when it is in its closed position it just touches the cane without deflecting it. The left / right position for this can be set using the adjustable stop for the right hand carriage or by using the linear slide which is provided for adjusting the whole cane drawing assembly in the left / right direction. This position will need adjustment according to cane diameter to avoid deflecting the fibre line.

Forward / back adjustment should not be needed when cane diameter changes but should be set so that the fibre line is down the centre of the belts. Slots and locking screws are provided on the base for this purpose.

Adjustment of Relative Axes of the Two Belt Systems

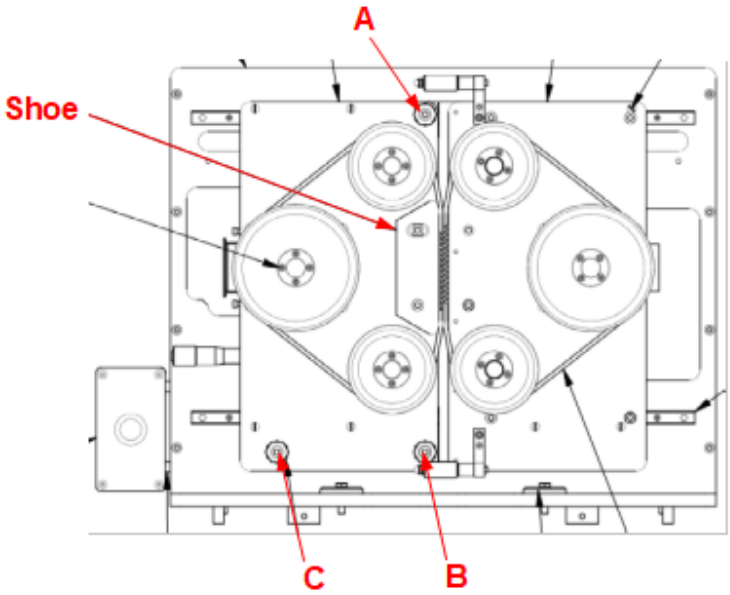
For the cane puller to run correctly the two opposing belts need to be parallel in all three orthogonal axes.

The belts need to be running parallel in the two orthogonal vertical planes. Parallelism could be out of alignment if for example one of the two opposing top pulleys was further out from the face of the tower than the other one, i.e. tilted in the front/back vertical plane. This would tend to introduce twist into the cane as it passes down the tower.

Parallelism could also be out of alignment if for example the two opposing top pulleys were closer together than the bottom ones (or vice versa), i.e. tilted within the left/right vertical plane. This would reduce the contact length between belts and fibre and perhaps cause slippage to occur.

Finally the two belts should run exactly square to one another, that is pressing equally together across their entire width. If their surfaces are not exactly parallel in the horizontal plane then the cane will tend not to stay in the middle of the belts but migrate towards the edge where the gap is or the pressure is lighter.

Means of adjustment has been provided on the left hand carriage assembly to allow fine tuning in all three of these axes. To do this it is necessary to remove the cover from the unit. There are two adjusters along the right hand edge. One is at the top (A) and one at the bottom (B). The third adjusted (C) is along the bottom on the left hand edge. To move the whole belts assembly forwards or backwards relative to the back plate use all three adjusters.



To adjust the forward-backward tilt use adjuster (A) only. To adjust the squareness of the left hand belt face relative to the right hand face use adjuster (C) only. The (C) adjust best done whilst drawing cane to ensure the cane stays centred in the belts. The other adjustments can be done off line using tools a spirit level, feeler gauges etc followed by confirmation on line by drawing where aspects such as induced twist can be checked.

Finally a positive contact between the belts is produced by a backing “shoe” located behind each belt along the pinch contact length. The shoes have mounting slots with lock screws. The shoes should be adjusted so that each belts rides over smoothly its respective shoe. Silicon grease lubrication to the tooth side of the belt can help in this respect. The shoes should be set so that the belt spacing is even along the contact length.

#

Maintenance

Routine maintenance is confined to inspection and cleaning of the belts between runs and the removal of any glass debris from the unit. Occasionally check for freedom of movement of the carriages tension of all belts and apply a drop of light machine oil to the drive linkages.#