

Reducing breakdowns in pulp pressing stations by improved operation and maintenance

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Reduzierung von Störfällen bei der Schnitzelabpressung durch bessere Überwachung und Instandhaltung

Increasing demand for pressed pulp of high dry substance content can cause very high workloads, especially on old presses which were designed for lower dry substance contents. The type of operation of the press and of the station as a whole can further stress these machines. With the aim of improving performance, as well, Babbini has recently remarkably increased the reliability of the critical components of its presses such as gearbox and spindles. However, in order to completely avoid failures and machine stoppages it is necessary for the user to take pre-emptive actions at several levels. It is possible to avoid breakdowns by ensuring that a complete maintenance schedule for press and gearbox is thoroughly followed, by periodically analyzing and checking certain press operating parameters, and use of additional monitoring and control instruments.

Key words: beet pulp presses, pressed pulp, operation of presses, maintenance, control systems

Steigende Nachfrage nach Pressschnitzeln mit hohem Trockensubstanzgehalt kann zu sehr hohen Betriebsbelastungen führen, vor allem bei alten Schnitzelpressen, die für geringere Trockensubstanzgehalte ausgelegt wurden. Die Betriebsweise der Pressen und der Anlage als Ganzes kann diese Maschinen zusätzlich belasten. Mit dem Ziel der Leistungsverbesserung hat das Unternehmen Babbini vor kurzem die Zuverlässigkeit der kritischen Komponenten seiner Pressen, wie z.B. Getriebe und Achsen, erheblich erhöht. Um jedoch Ausfälle und Stillstandszeiten der Pressen ganz zu vermeiden, sind für den Anlagenbetreiber verschiedene präventive Maßnahmen notwendig. Es ist möglich Störungen zu vermeiden, indem sichergestellt wird, dass ein vollständiger Instandhaltungsplan für Pressen und Getriebe sorgfältig eingehalten wird sowie durch Analyse und Überprüfung bestimmter Betriebsparameter der Schnitzelpresse in regelmäßigen Abständen und durch Verwendung zusätzlicher Überwachungs- und Kontrollinstrumente.

Schlagwörter: Schnitzelpressen, Pressschnitzel, Pressenbetrieb, Instandhaltung, Überwachung

1 Introduction

Babbini has manufactured double-spindle presses for beet pulp for about 40 years. It has noticed a growing interest in the following aspects:

- Beet pulp presses now play a more important role in beet sugar manufacture in comparison of what they did in the past thanks to the economic advantage coming from energy savings and from sugar and water recovery which mechanical presses allow.
- Breakdowns of beet pulp presses due to failures or simply to unforeseen events, often last longer than in other parts of the sugar factory, and they can create big difficulties for the operation of the entire factory.

Therefore it is very important, both for manufacturers and users of beet pulp presses, to adhere to the following interconnected aims, i.e. to:

- increase the performances of presses, and at the same time to
- increase the reliability of the presses.

2 Causes of breakdowns

Analysis of the causes of the mechanical breakdowns over many years suggests that both the press manufacturers and the users should share the blame for having underestimated the problems. Breakdowns mainly occur as a result of stress the presses are undergoing, mainly because of the following:

- Demand for higher dry substance contents of the pressed pulp. In the past, the required dry substance content was 22–24%. Nowadays, the DS content has increased to over 30% for pulp which is sent to a drier (for pulp used for bio-gas production, there are different parameters).
- Pulp presses have to withstand a high mechanical stress which leads fatigue of the steel. This fatigue grows exponentially with increasing workload due to the demand for higher dry substance contents of pressed pulp. The mechanical stress is still further enhanced, if the press is operated in an “unstable” way, i.e. by operating it a varying speed or feeding it discontinuously. Harmful are also varying physical characteristics of the cassettes or too high or too low



Fig. 1: Damage due to the entrance of a foreign object

contents of additives. A poor “unstable” operation of a press is also one of the possible causes for the reduction of its performance.

- Insufficient maintenance: The general need for reducing sugar manufacturing costs lead to a reduction in particular in the expenses for maintenance.
- Poor monitoring.
- Entrance of foreign bodies (Fig. 1).
- Presses installed in the open air.

3 Remedies and solutions

3.1 Higher reliability of the critical parts of the press

In the course of the last years, Babbini increased the reliability of its presses and in particular of the critical components: gearbox and spindles. The gearbox safety has been increased in order to make it more reliable, even under higher workloads.

Babbini today has its gearboxes manufactured by GPS (Fig. 2), a associated company which is part of the Cangia-

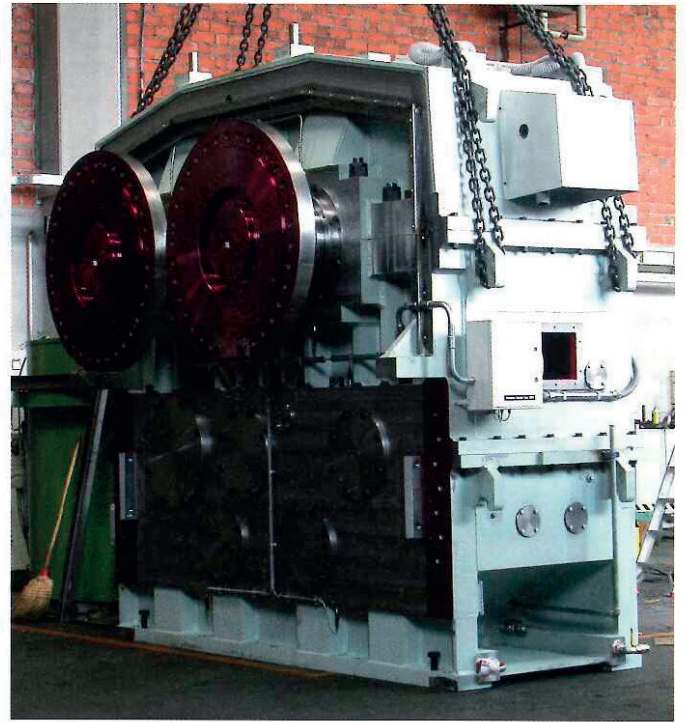


Fig. 2: A GPS gearbox for a PB48Sp press with vibrations gear case and dehumidifier (vibrations gear case is a panel where all vibrations read on the gearbox are collected for reading)

leoni Group. Thus a higher quality of the complete press is assured thanks to

- direct manufacturing control due to close and continuous cooperation with the gearbox manufacturer,
- possibility of customizing the supply and storage of all spare parts for the gearboxes,
- pre-assembly and testing of all presses in the workshop (Fig. 3).

In addition it is possible to the train the customers at this occasion.

Spindles: In cooperation with scientific institutes, welding



Fig. 3: Pre-assembly of the presses in the workshop

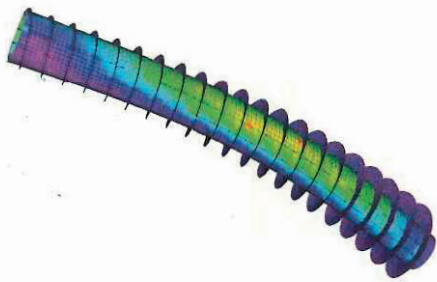


Fig. 4: Example of a FEM calculation on a press spindle



Figs. 5a and 5b: Endoscopic controls inside the gearboxes

institutes and sugar factories Babbini carried out a thorough study to elicit problems associated with increasing workload. As a result Babbini has completely redesigned the press screws starting from the check of the strength of the supporting structure by finite element method (FEM; Fig. 4).

Babbini analyzed the entire manufacturing cycle and a substantial part of it has been modified on the basis of

- new manufacturing technologies,
- new materials,
- reduction of the number of critical welding points (both welding of the internal structure and of the coating),
- minimization of the residual tensions resulting from welding,
- new controls.

All the above points make the press spindles, in particular the self-draining ones, stronger and more reliable, while keeping the same overall dimensions.

Press: The whole press in general has been strengthened.

3.2 Improved press maintenance

Even if one is aware of the need of keeping costs low, maintenance is a fundamental way of preventing damage which cannot otherwise be easily avoided. The following maintenance points should be carried out:

- Regular lubrication of the rotating parts during the campaign.
- Periodical activation of the oil circulation pump + gearbox rotation,
- Cleaning of the gearbox filters, i.e. delivery filter and suction filter,
- Replacement of the hygroscopic filters, when necessary
- Check of the correct tightening of the screws (spindles supports and foundations).
- Endoscopic control of the gearboxes as preventive maintenance by complete internal inspection (Figs. 5a and 5b). This is not so expensive if one considers the risk of troubles with the gearbox. The period between the controls depends on the gearbox age and type of press. It should allow to determine to what extent gears are worn out based on their use and on statistics and of the bearings based on their theoretical life time and on their workload. Depending on the state of a gearbox, its age and level of its use, it is possible to carry out a complete overhaul of a gearboxes (partial or

total replacement of the bearings, magnetoscopic check of the gears, complete overhaul of the lubrication system, etc.).

- Opening of the presses as preventive maintenance: Depending on the level of stress on press, it is advisable to open the presses (especially the older ones) every two or three years in order to check the conditions of the spindles, the perforated plates, the press level (to check the correct position of the press on foundations).

3.3 Check and analysis of press operation

During the campaign it is necessary to control/monitor the following operating parameters:

- Pressure and temperature of the gearbox oil (preferably continuously).
- Power absorption. Continuous monitoring of the power absorption, with an arrangement for safety levels and activation of protective actions depending on the power uptake. The power uptake is the main source for the knowledge on stress on presses and therefore of the possibility of breakdowns.
- Periodic control of the flushing systems of spindle and cage.
- Analysis of gearbox lubricant for contamination with water and iron particles. This must be carried out more frequently for old gearboxes, already showing the first signs of wear. The gearbox lubricant should be replaced/filtered in case of presence of water or iron particles.
- Detection of vibrations on the gearbox elements.

3.4 Use of control and monitoring instruments

Today the following monitoring instruments are available which should be installed both on new and second-hand pulp presses to control the:

- Rotational speed of spindles (Fig. 6)
- Pulp outlet clogging
- Oil cleaning (gearbox): off-line filtration gear case (Fig. 7)
- Electrical level indicator of oil level in gearbox
- Electrical flow indicators of oil flow in gearbox
- Electrical indicators for oil pressure and temperature in the gearbox, and in oil heater and oil cooling system
- Moisture (gearbox): dehumidifying system
- Vibration detector for the gearbox (accelerometer; see Fig. 8).

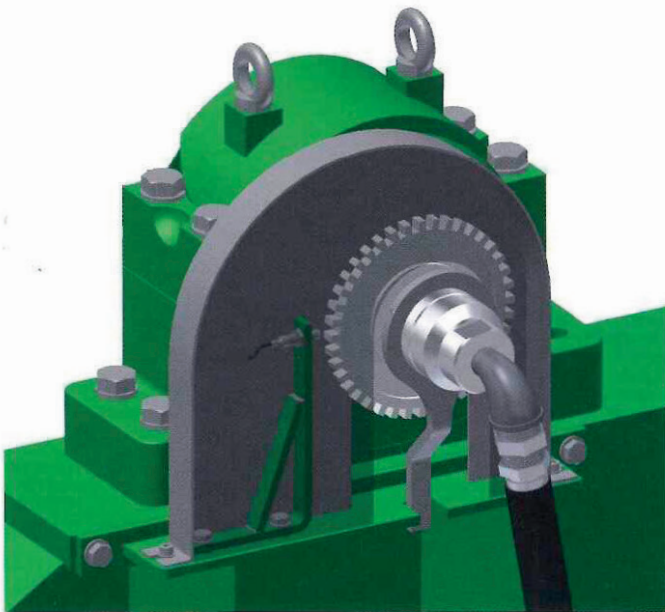


Fig. 6: Press screws rotations control



Fig. 7: Off-line filtering gear case

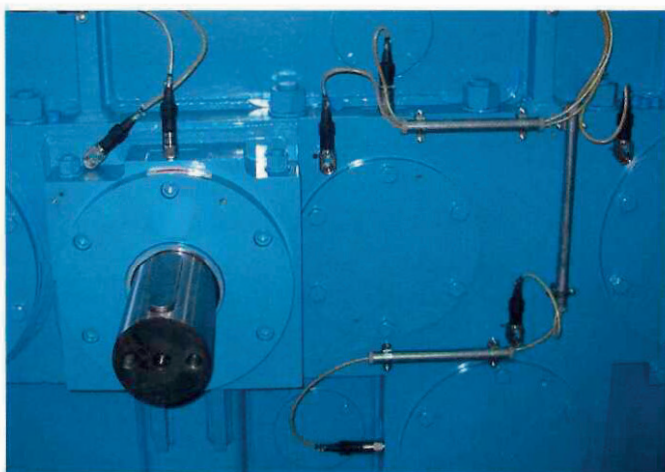


Fig. 8: Vibration system accelerometers

3.5 Operation of pulp presses, the pulp pressing station and the process

For a complete protection of the presses it is highly advisable to keep under control the following aspects, tightly connected to the operation of presses, which can cause anomalous mechanical stress on certain components.

Operation of individual presses

- Avoid variations in speed of press spindle and/or too high speed.
- Try to keep the feeding hopper as full as possible
- Whenever possible, avoid a restart-up with full load of the press.

Station

- Distribute workload on individual presses depending on their characteristics and age.

Arrangement of the enabling signals for the presses start-up and stop and the activation of the alarms depending on:

- Signals from the control devices (press, gearbox, motor)
- Operation or stop conditions of the machines connected to the press (conveyor after presses, drive motor, etc.)

Beet processing

Operation of the beet extraction with non-ideal parameters or with parameters varying very much with time can cause significant mechanical stress on some components of the press. Problems can derive from:

- Sudden changes in the beet processing parameters.
- Highly variable and/or too low pH value in the extraction due to variations in sulphuric acid dosage.
- Changes in lactic acid formation/contents of juice – a controlled infection in the extraction with a minimum dosage of sulphuric acid is preferred.
- Excessive hardness of extraction water due to high gypsum dosage, especially in case of a high marc content of beet.
- Low extraction temperatures, especially during start-up, or a too high extraction temperature.
- Excessive content of fine pulp, which should be eliminated by proper slicing machine operation. Fine pulp clogs the holes of the perforated plates, thus negatively affects the dewatering capacity of the press.
- Poor beet washing leading to excessive presence of sand clogging the holes of the perforated plates, especially in presses equipped with special en bloc perforated plates (Fig. 9).

Figure 10 shows a screen plate deformed due to clogging of holes. Many of the aspects pointed out in section 3.5 can considerably affect also the final dry substance content of the pressed pulp.

4 Conclusions

In order to come as close as possible to the physical limits of mechanical dewatering, it is necessary to provide suitable



Fig. 9: Deposit of sand on the filtering cage



Fig. 10: Cage screen plates deformed by holes clogging

working conditions for pulp presses. Safety and good performance of a press not only depends on its design and manufacture, but also on how it is both operated and maintained. The users must be aware that, inside a sugar factory, the press is one of the equipments most subjected to stress. It is therefore necessary to pay attention to pulp presses as it is with any of the process equipment.

Therefore, the user himself, who operates the beet end of the factory, of which the pulp press station is a very important part, can avoid breakdowns by taking simple precautions and pre-emptive measures which have not been standard up to now. This applies in particular to old, highly-stressed presses which are installed in the open air. Babbini places at the disposal of their customers a maintenance, assistance and monitoring services for presses the company supplies.

Réduction des incidents lors du pressage des pulpes grâce à une meilleure surveillance et un meilleur entretien (Résumé)

La demande croissante pour des pulpes pressées à haute teneur en matières sèches peut causer des charges de travail très élevées, en particulier avec de vieilles presses conçues pour des teneurs en matières sèches plus faibles. Le type de fonctionnement de la presse et de l'atelier dans son ensemble peut, en outre, surcharger ces machines. Dans le but d'améliorer les performances, la firme Babbini a tout récemment augmenté la fiabilité des composants sujets à critiques de ses presses tels que le système d'engrenage et les axes. Toutefois, afin d'éviter complètement ces défaillances et les arrêts des presses, il est nécessaire pour l'utilisateur de prendre des mesures préventives à plusieurs niveaux. Il est possible d'éviter les pannes en

s'assurant qu'un programme complet d'entretien des presses et des organes de commande soit suivi minutieusement en procédant périodiquement à l'analyse et au contrôle de certains paramètres de fonctionnement de la presse et en faisant usage d'instruments additionnels de surveillance et de contrôle.

Reducción de fallas en el prensado de la pulpa por mejor control y mantenimiento (Resumen)

Una mayor demanda por pulpa prensada con un alto contenido de materia seca puede ocasionar muy altas cargas de servicio, especialmente en prensas viejas dimensionadas para contenidos de materia seca más bajos. El modo de operación y el tipo de prensas en total puede exponer a las máquinas aún a una mayor carga. Con el fin de aumentar el rendimiento de las prensas, Babbini recientemente ha mejorado considerablemente la fiabilidad de los componentes críticos como engranajes y ejes. Para el usuario de la planta varias medidas preventivas son necesarias para poder excluir completamente algún paro o cualquier falla de las prensas. Es posible evitar fallas con un plan de mantenimiento para prensas y engranajes observado y cumplido concienzudamente, con análisis y controles de ciertos parámetros de la prensa de pulpa llevados a cabo periódicamente y con el empleo de instrumentos adicionales controladores y supervisores.

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