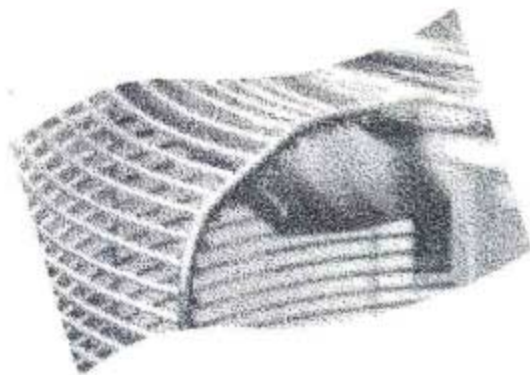


Protective shield for mixers for the use of pastry-cooks



ÉTUDES ET RECHERCHES

Joseph-Jean Paques
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Protective shield for mixers for the use of pastry-cooks

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This study was financed by the IRSST. The conclusions and recommendations are those of the authors.

Pastry-cooks – a protective shield for the hands

Starting point

An application submitted to the CSST by the Association of Pastry-cooks to make the protective shields used on mixers meet the needs of its members

Responsible researchers

Joseph-Jean Paques and Real Bourbonniere. IRSST safety engineering programme.

Partners

The CSST, the Association of Pastry-cooks and five pastry-cooks.

Result

Technical specifications identifying the design, manufacture and installation features of a protective shield, its accessories and a locking system.

Potential users

Pastry-cooks and other users of food mixers, accident prevention personnel in the food industry and manufacturers of mixers or safety shields.

Mixing machines are used to a large extent in the food industry. Before 1988, very few of them were equipped with safety devices, presenting a risk that the rotational movement could trap a finger, arm or forearm. At that time, the Jacques-Viger Hospital, the Industrial Health & Safety Association – Social Affairs Division (ASSTSAS), the CSST and the IRSST combined in an effort to design a safety shield. Since then, although without uniformity, the use of a safety shield has become more widespread, except for pastry-cooks, because it hampers them in their work. Appealed to by the Association of Pastry-cooks to find a solution, the CSST again requested the Institute's assistance. The objective: to demonstrate the feasibility of a protective shield, which would be at once practical, safe and adapted to the needs of pastry-cooks.

Procedure

Conventional safety shields do not enable pastry-cooks to add ingredients to a mixture in progress, which is frequently necessary. To resolve this difficulty, Joseph-Jean Paques and Real Bourbonniere, of the IRSST safety-engineering programme, solicited comments from five pastry-cooks and monitored their work. Together, they identified all the situations where the protective shield presented problems, since according to the temperature and texture of the ingredients; the difficulties are not always the same. With the help of these data, they were able to specify and order three models of a prototype, which, tested in three establishments, proved entirely satisfactory to the users.

The specifications drawn up at that time cover the design, manufacture and installation of a shield, a locking system and, if required, a braking system for mixers having a capacity of from 30 to 80 quarts. They also include specifications for the installation of a scraper, an option recommended by the research team (with the exception of aluminum hoppers), since this favours productivity while reducing dangerous interventions.

Safe and practical

Designed according to these specifications, the protective shield is both practical and safe. All risks of danger have been neutralized. The spacing between the bars prevents the worker's fingers, hand or forearm from getting into the active zone of the mixer. It also prevents the rotating parts from trapping manual tools such as spoons or spatulas. In addition, positional

switches enable the machine to be started up only when the safety shield is in place, the hatch securely closed and the hopper in the raised position. There is, however, an exception to this last requirement, since it may be necessary for the worker to raise the hopper progressively from its low position while simultaneously operating the rotational mechanism. The research team skirted this danger by providing that at that time both the operator's hands would be in use: with one hand, he will control the operation of the mixer while, with the other, he will control the elevation of the bowl.

Both safe and practical, the protective shield specified by the IRSST comprises a pouring spout and a hatch permitting addition of all required ingredients to the initial mixture without risk. The apparatus can only begin to work with the protective shield is installed, the hatch closed and the bowl in the raised position

The protective shield owes its practical side to the shield hatch and the pouring spout through which the pastry-cook may add all the required ingredients to the initial mixture, at the required frequency and without risk. By opening the shield hatch, he may pour ingredients of all types into the hopper, but the locking system will then cause immediate stoppage of the motor. With the pouring spout, he may also add ingredients such as hot liquid sugar or other liquid, semi-liquid or powdered ingredients, while maintaining the rotating motion.

The specifications prepared by the Institute's engineers allow pastry-cooks to order from the manufacturer, protective shields that will fit their own equipment. Particular attention was given to the installation procedure, which must include several tests and verifications, designed for the manufacturer producing the shields...

A trend to be encouraged

According to Mr. Jocelyn Jargot, who collaborated on the project when he was working with the Prevention-Inspection Directorate of the CSST, protective shields are being used more and more in Quebec. "When we realize that the average cost of a protective shield corresponds more or less to the cost of an industrial accident, this appears cost-efficient", he says. Already, Hobart, the major supplier to the food industry in Quebec, is in a position to equip its mixers with a safety shield complying with the specifications laid down. As a result of this study, the CSST believes it can also alert several actors within this industry. To this effect, it plans to promote the specifications to various groups involved, including the Association of food retailers and the Association of Restaurateurs of Quebec.

By Danielle Masse

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INTRODUCTION

This technical specification has been produced with a view to ensuring that the protective shields attached to mixers used by pastry-cooks will meet their needs while ensuring their safety.

The aim of these protective shields is to protect workers against the principal risk identified which is that of having a finger, hand or forearm entrapped by the rotatory movement of the mixer tool. This hazard is described in detail in the technical safety notice No. 21, entitled Mixers, Kneading machines and similar equipment, published by the National Institute of Safety Research, No. 1176-95-79. Nancy, 1979.

The details of this specification were established in the context of an IRSST research and development project aimed at analyzing the specific needs of pastry-cooks and demonstrating the feasibility of a protector, which would meet these needs. In the context of this project, the execution of each recipe of the pastry-cooks participating in the project was analyzed; particular specifications and recommendations as to work methods arose from this. The whole was validated by pastry-cooks who tested the use of protective shields manufactured in accordance with this specification.

1. PROTECTIVE SHIELD AND SUPPLY RESTRICTIONS

This technical specification concerns the design, manufacture and installation of a protective shield and its accessories, on mixers having a capacity of 30 to 80 quarts, used by pastry-cooks. This specification also includes the design, supply of components and installation of an interlocking system working as described below.

As an option, this technical specification also includes the supply and installation of a scraper tool, which will scrape the side and the bottom of the mixing hopper continuously, as soon as the tool-carrier is in operation. This option is recommended, since it improves productivity while reducing hazardous intervention situations. This scraper tool, however, is not recommended for aluminum hoppers, with which, according to our observations, it is not compatible.

Any modifications, whether mechanical or electrical, which must be made to existing mixers, must be performed according to professional practice by qualified and experienced personnel and in accordance with all applicable laws and regulations.

2. FUNCTIONAL DESCRIPTION OF A MIXER EQUIPPED WITH THE SAFETY SHIELD

2.1 General functions of the safety shield and the interlocking system

The safety shield prevents a finger, hand or forearm of a worker from direct access to the operating area of the mixer tools. It is manufactured in rigid form, preferably of stainless steel, and comprises an access hatch and a pouring spout to add ingredients to the hopper.

The protective shield also prevents the entrapment by the rotating tools of manual accessories such as spoons, spatulas, etc.

Closing of the shield hatch, and even the presence of the shield, is detected by a magnetic position switch, preferably coded.

Detection of the high position of the hopper will be done by another positional switch, either a magnetic type with a coded target, or an electronic type with positive activation and forced opening of contacts.

Starting the motor will only be possible if the contacts of the two switches are closed. The recommended modifications should not alter the safety devices normally supplied with the mixer, e.g., stoppage of the motor when the speed change lever or any other device is activated.

If it is necessary to brake the motor rotation, a one shot timer or other device will automatically activate the brake each time that the motor is stopped by opening the contacts of either of the two added position switches.

2.2 Functional criteria of the shield and interlocking system

2.2.1 Use of the mixer for different recipes

Once in place, the shield must permit access to the hopper, after stopping the rotation of the mixing tool and opening the hatch.

The design, manufacture and installation of the safety shield and its interlocking system must permit performance of the following detailed operations:

- **Advance filling of the mixing bowl** (either in the lowered position or by opening the access hatch) with the required ingredients (solid, liquid, soft, creamy powdery or other);
- Addition during preparation, by stopping the mixer and opening the shield hatch, with all types of ingredients required, of whatever type (composition, consistency, shape and size);
- **Without stopping the mixer:**
 - Pour liquid sugar (at about 121°C) using the pouring spout, the lip of which should preferably be located at about 2 cm from the inner surface of the mixing hopper;
 - Use the pouring spout to add liquid or semi liquid materials such as water, whole eggs, egg yolks, hot cream, softened chocolate, liquid chocolate, custard cream, pre-mixed cream and chocolate, whipped cream, milk, vanilla, inverted sugar, liquefied gelatine, liquid butter;
 - Use the pouring spout to add powdered ingredients such as flour, powdered chocolate, granulated sugar, powdered sugar, etc;

- **Permit the operation of the mixing tools during the lowering or raising of the mixing bowl**, provided that the operating control is held in one hand while the worker's other hand is used to control the downward or upward movement of the bowl.

2.2.2 Ergonomic design of the protective shield and its accessories

The protective shield must be light and easy to take apart, with handling points. It must withstand immersion for washing. The parts of the shield, which are not detachable, must be easy to wash. The pouring spout may be removed from the shield to facilitate cleaning.

The shape, slope and opening of the pouring spout must be such as to facilitate the flow of the various products to be poured, described above in paragraph 2.2.1

The smoothing of sharp ribs and the shaping of the metal must facilitate cleaning and avoid the accumulation of bacteria, while eliminating the danger of cuts.

The design and manufacture of the pouring spout must be such as to minimize the risk of projection and spillage.

The positioning and dimensions of the pouring spout must take into consideration the user's position at the time of pouring, so as to provide sufficient clearance and permit easy and ergonomic use, taking into account the size and weight of the receptacles used to pour the ingredients.

The protective shield must be sufficiently rigid and firmly attached not to produce noise caused by the operation of the machine.

2.2.3 Dimensions of bowls to be protected

The protective shield and the pouring spout must provide adequate protection for the workers when they use two different sizes of bowl with the same machine (e.g., 30/60 or 40/80 quarts).

2.2.4 Mixer tools

The design of each protective shield must take into account the tools normally used for the machine in question. It is important to note that each type of machine may have characteristics (bowl size, speed of rotation, power, presence of accessories, shape of tools, etc.) liable to modify the shape and size of the protective shield.

The scraper proposed as an option must permit scraping the bottom and sides of the bowl continuously, so as to facilitate the uniformity of the mixture and the cleaning of the hopper.

2.3 Safety criteria

The shield and interlocking system must comply with the following safety criteria:

- Rotation of the tools must be possible only if the shield is in place, the access hatch closed and the mixing bowl in the raised position;
- It must be possible, however, to engage the rotary movement of the mixing tools when the bowl is not in the raised position, by pressing continuously on the mixer's press-button start switch. As soon as the start button is released, the movement will stop, as long as the bowl is not in the raised position. In this mode of operation, however, the other switch monitoring the closing or presence of the shield remains fully active and will cause the mixer to stop.

Note: if the existing controls of the mixer to be equipped are of the rocker switch type, these must be replaced by push-buttons with spring-loaded return.

- The dimensions of holes or free spaces in the shield must comply with the international standard entitled "**Machine safety – Safety distances to prevent upper limb access to hazardous areas**" (ISO 13852, 1997). For instance, the dimensions of round or square openings in the shield must not exceed 12 mm when the hazardous internal movement occurs less than 80 mm from the wall of the shield:

Note: it is strongly recommended not to open the space required to attach the pouring spout if this item is not required.

- If the mixer is equipped with an electrical control for raising the bowl and when the bowl is not in the raised position:
 - the rotational movement of the tools must be possible only when the push-button switches for starting the motor and raising the mixing bowl are activated simultaneously;
 - as soon as either of these buttons is released, the rotational movement of the tools must stop, as long as the bowl is not in the raised position;
- Stoppage of the motor upon opening the hatch must be fast enough to prevent the operator's fingers from being struck or entrapped before the movement of the parts has ceased. It is possible that the use of a brake may be required to satisfy this clause;
- Mounting screws for the position switches and their accessible magnetic targets must be such that:
 - either it is impossible to loosen them,
 - or a special tool is required to loosen them;
- If magnetic switches are used, it must be impossible to circumvent their protective function by placing a magnet in any location other than the housings provided by the manufacturer for the magnetic targets.

In addition, particular attention must be paid to the permanent fixing of small parts such as screws, pins, etc., in order to ensure that they cannot fall into the mixing bowl during work.

3. DETAILED DESCRIPTION OF THE PARTS TO BE SUPPLIED AND INSTALLED

This technical specification covers the following items:

3.1 Protective shield

The supply of the protective shield must comprise a minimum of the following components:

- A protective shield with hatch, pouring spout (preferably movable) and device for attaching and detaching the shield on the body of the mixer;
- Any other component deemed useful to meet the criteria set out above.

3.2 Interlocking system

Supply of the interlocking system must comprise a minimum of the following components:

- A magnetic targeted position switch, preferably coded, and its wiring, to detect the presence and complete closure of the protective shield and its hatch;
- A position switch, either of magnetic target type or electromechanical with positive action and forced opening of the contacts to detect the raised position of the bowl;
- If braking the rotation of the motor is required, a one shot timer or equivalent, or any other equivalent device;
- Any other component deemed useful to comply with the criteria set forth above.

The recommended position switches are as follows:

- Shield hatch: magnetic safety switch EJA FRS-6 or equivalent;
- Bowl raising: magnetic safety switch EJA FRS-4 or equivalent or position switch of electromechanical type with positive action and forced opening of contacts.

Note: magnetic safety switches may be obtained from :

E.J.A. ENGINEERING CO. LTD., Blanchard Works, Ormside Close, Hindley Green Industrial Estate, Wigan, Lancashire, England WN2 4HR, Telephone: (0942) 55166, Fax: (0942) 523259

Or from one of its distributors in the United States:

STI, 31069 Genstar Rd., Hayward, CA 94544-7831, USA, Telephone: 1 800 221 7060, Fax: 510 471 9752.

3.3 Brake

If braking the speed of the motor is required, supply of the braking system must include a minimum of the following components:

- An active braking device, if such is not already available on the machine;
- Any other component deemed useful to satisfy the criteria set forth above.

3.4 Options

If the scraper option is selected supply of the scraper must include a minimum of the following components:

- A scraping tool adapted for use on the machine concerned;
- All necessary accessories for attachment and detachment;
- Spare parts for maintenance and wear replacement recommended for one year of normal continuous use;
- Any other component deemed useful to satisfy the criteria set forth above.

3.5 Modification and installation

Allow for the installation on the designated machines of all components supplied. This includes any modification and adaptation work on the existing machines, required to integrate the components supplied.

Any such modification work should preferably be done without moving the machines and as quickly as possible so as to reduce downtime to a minimum.

4. DELIVERY TESTING OF THE PROTECTIVE SHIELDS AND THEIR INTERLOCKING SYSTEM

Upon delivery of the protective shields on each modified mixer, the following tests and verifications must be performed:

4.1 Before installation of the shield on the mixer

- The quality of polishing and welding of all stainless steel elements making up the shield and its accessories must be checked visually. Welds must be uninterrupted and without cracks or inclusions;
- Safety dimensions such as the space between the bars of the hatch, diameter of holes in the sheet metal, must be measured and checked in relation to the distance to the hazard, in accordance with ISO Standard 13852;
- Rigidity of the shield must be checked by attempting to deform it by hand.

4.2 After installation of the shield on the mixer

- Before restoring electrical current to the mixer, the shield should be installed and removed several consecutive times to ensure a proper fit on the mixer. Installation and removal operations should be performed easily and without undue effort;
- Similarly, the shield hatch should be opened and closed several consecutive times;
- Next, it should be checked that none of the movable elements of the mixer, including all tools likely to be used, interferes with the shield or its components and that they present no risk of injury to the operator when the shield is in place and closed;
- After restoring electrical power to the mixer, a functional test of the shield and of the safety switches must be performed;
- After starting the rotation of the mixer tool, it must be verified that each of the following conditions will stop the machine automatically
 - opening the shield hatch;
 - lowering the bowl support;
 - activating the speed change lever (if applicable);
- The disappearance of the unsafe condition should not cause the mixer to start up again, this must be possible only when the operator again presses the start button after the unsafe condition has disappeared;
- A test will permit verification that the absence of the shield will prevent any start-up of the mixer motor;
- A test must be performed to check that it is possible to raise or lower the bowl while the mixer motor is running, by holding down the run control button;
- If applicable, a test must be performed to check that the brake is activated automatically in the case of:
 - opening the shield hatch;
 - lowering the bowl support;
- a braking test must be carried out for all possible rotation speeds in order to verify its efficiency and good operation;
- the good operation of the scraper must be verified, if applicable;
- coordination of the electric raising movement with the rotation of the tools must be checked, if applicable.