UBLE RAIL RESTRAINER SYSTEM FOR HOLDING LARGE BEEF CATTLE DURING STUNNING

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cattle, stunning and shackling the double rail restrainer conveyor is superior compared to the V restrainer. This technology eing rapidly adopted by the U.S. beef industry. Ten systems have been installed during the last two years. Some of the vantages of the double rail compared to the V restrainer are: 1) easier and more accurate stunning, 2) wider range of justment of different sized animals, 3) cattle enter more easily and 4) separation of rear legs facilitates shackling.

TRODUCTION

e double rail conveyor was initially developed for use in slaughter plants which process calves and sheep (Giger et al., 1977; Stevelt et al., 1976; and Grandin, 1987, 1988a). The first system used in a commercial calf and sheep slaughter plant was signed by Grandin (1987, 1988a). The double rail provided many advantages compared to the V restrainer, such as: 1) more fficient and accurate stunning, 2) wider range of adjustment for different sized animals, 3) animals entered more easily and 4) eparation of the rear legs facilitated shackling. The objective of this project was to build a larger double rail restrainer for adult tle.

TERIALS AND METHODS

e double rail restrainer was installed in a commercial beef slaughter plant that processed 240 grain-fed cattle per hour. The ttle weighed 225 kg to 600 kg with an average weight of 475 kg. The existing V restrainer was removed and the double rail strainer was installed in its place. The existing shackling system and take-a-way conveyor remained. The installation was mpleted in one weekend. For a description of the shackling and take-a-way conveyor system, refer to Edwards (1972), illems and Markey (1972) and Grandin (1983). The double rail restrainer was an exact copy of the calf restrainer except it was dened.

scription of the System. The double rail system layout, elevation and cross sections are shown in Figures 1, 2, 3 and 4. The basic eration of the system is similar to the V restrainer and double rail systems described in Grandin (1987, 1988a). The system nsists of a single file entrance ramp, double rail conveyor, shackle rail, table conveyor and incline conveyor.

ttle walk up a ramp to the restrainer entrance and straddle a stationary leg spreader bar which positions their legs on each side f the moving double rail conveyor. While the animals ride astride on the moving double rail, they are stunned with a captive ll and the shackle is attached to one rear leg. The stunned animals are discharged off the double rail onto a moving table nveyor. The shackle trolley is then picked up by a moving inclined conveyor which moves the stunned shackled animal to the ed area.

The top of the double rail conveyor flights where the animals ride astride had a minimum height of 213 cm above the plant floor. The entrance race floor was even with the top of the conveyor flights. Cattle walked up a single file ramp to a level entrance race. Design specifications for ramps and crowd pens for bringing cattle in a single file up to the entrance chute can be found in Grandin (1988b). There was 3 m of level race floor prior to the cleated non-slip entrance ramp. The leg spreader bar was 45 cm high and a cross section is shown in Figure 1. This bar positions the animal's legs on each side of the conveyor. The animal then walks down a cleated non-slip entrance ramp located on each side of the conveyor. This ramp is on a 25° degree angle. When the animal becomes high centered, it is moved along the conveyor supported by its brisket.

The double rail conveyor consists of metal segment flights attached to a chain. It is similar to the conveyor described in Gra (1988a). The moving portion of the conveyor is 26.6 cm wide and 6.5 m long. It has a depression in the center to fit the anim brisket. The depression for the animal's brisket (sternum) is 7.60 cm deep and 7.60 cm wide at the top. The double configuration is formed by three smoothly intersecting arcs. The stationary conveyor framework is 30 cm wide.

The adjustable side design is also similar to the design used in the calf restrainer (Grandin, 1988a). Figure 2 schemati illustrates the position of the adjustable sides for both small 255-kg cattle and large 800-kg cattle. Hydraulic cylinders conne to mechanical linkages move the sides. The adjustable sides press loosely against the upper position of the animal's body gap below the bottom edge of the adjustable sides provides space for the shoulder joints. When the sides are in the position the smallest cattle, there is a 15-cm gap between the bottom of the adjustable sides and the top of the double rail restra conveyor flights. To prevent injuries to the shoulders of incoming cattle,, the adjustable sides are equipped with spring-loa flapper gates to guide the cattle between them.

Cattle are stunned with a captive bolt when their heads emerge from underneath the level portion of the hold down rack (Fig 3). The platform that the stunner operator stands on is even with the top of the conveyor flights (Figure 2). The stationary s of the stunner operator's side is 91 cm high. Shackling is accomplished after the animal is stunned while it is still astride conveyor. After shackling, the stunned animals are discharged onto the conveyor table and go up an incline conveyor. Th components are the same as those used with the V restrainer.

RESULTS AND DISCUSSION

The double rail restrainer has successfully operated under commercial conditions for over two years. The U.S. beef indust rapidly replacing V conveyor restrainers with double rail restrainers. During the last two years, ten double rail restrainers h been installed in beef slaughter plants. Cattle appeared to be comfortable while riding on the conveyor. Cattle sat quietly the conveyor during line stoppages of over one hour.

There were three modifications that had to be made to make the restrainer work efficiently for the larger, wilder beef ca These modifications were not required for tame formula-fed calves and sheep.

1. False Floor - This prevents incoming cattle from seeing the 200-cm drop off below the conveyor (Figures 2 and 3). T animal's feet do not touch the false floor while it is riding astride the conveyor. Installation of the false floor facilitat cattle entry and greatly reduced balking.

2. Extended Solid Hold Down Rack - This prevents cattle from being able to see out until they are completely settled do on the conveyor and their rear feet are off the entrance ramp (Figure 3). The level portion of the solid hold down ra is 183 cm long and the slanted portion of the hold-down rack is 10 cm above the back of an entering animal. If the ho down rack was too short, cattle reared and were difficult to stun. Extending the hold down length induced the anim to ride quietly. The hold down blocks the animal's vision and it may have a similar effect as the "dark box" chute whi is used for artificial insemination of cattle (Hale and Friend, 1987). Blocking an animal's vision has a calming effect an reduces stress (Douglas et al., 1984; Kinsman, 1986). The calming effect of a longer hold down rack may also be due "making the animal feel restrained." The system works more efficiently and the cattle stay calmer if they are complete settled down on the conveyor before they come out from under the hold down. The behavioral effect of blocking the visio is so powerful that an animal seldom bumps the hold down rack. During experiments to determine the proper length o the hold down rack, cardboard was used to test different rack lengths. The cattle seldom tore the cardboard.

Lighting - Lighting of the restrainer entrance is very important. The cattle have to be able to see into the entrance. If the entrance is too dark, the cattle may refuse to enter. At one plant, a burned out light bulb at the entrance caused balking. Recommended lighting is abundant overhead lighting 3 m over both the entrance and the stunner's platform. Light should not come up through the false floor.

Safety and Humane Advantages. Ergonomic measurements by Industrial Biomechanics, Inc. of Oak Ridge, North Carolina indicated that back strain for the stunner operator is significantly reduced compared to a V restrainer. There is a reduction of pressure of 28 kg at the lumbar 5/sacral 1 level. Back strain is reduced because the stunner operator can stand 28 cm closer to the animal. He can stand straighter because he no longer has to reach over the return portion of the V restrainer conveyor. Improved ergonomics for the stunner operator also results in more accurate and humane stunning. The percentage of poorly stunned cattle has been cut in half. Poorly stunned cattle are an extreme safety hazard to people working in the line because they often kick employees. At one plant, the reduction in poorly stunned cattle paid for the double rail restrainer in six months by reducing line stoppages. Line stoppages cost up to $200 per minute in large plants. Another major safety advantage is that it is extremely difficult for live cattle to escape from the restrainer and get out on the stunner operator's platform. The high, solid sides hold the animals in. In a V restrainer, cattle escape onto the stunner operator's platform much more frequently.

Cattle enter the double rail restrainer more easily because they can walk in with other legs in a normal position. In the V restrainer, the legs must be pushed together. Less prodding is required to induce cattle to enter the double rail system. At one plant, the author was able to move four out of five cattle into the restrainer without the use of an electric prod. The line speed at this plant was 350 head per hour. Employees at three plants had to be retrained not to bunch cattle together. Bunching cattle together improves entering efficiency in the V restrainer, but it causes some cattle to get their legs in the wrong position in the double rail. Cattle will always position their legs on each side of the leg spreader bar if they are allowed to walk in without being crowded together. When cattle are driven gently, they will walk in willingly.

The double rail restrainer provides the tools which make humane handling and stunning easier and more efficient. To work efficiently and humanely, managers must control employee behavior. At two of the ten plants that have double rail restrainers, employees were allowed to handle cattle in an abusive manner. This resulted in line stoppages, downed cattle and jammed equipment. It is the responsibility of management to stop rough handling.

CONCLUSIONS

Double rail restrainers are operating in ten large beef slaughter plants in the U.S. and Canada. These plants slaughter 150 to 350 large grain-fed steers per hour. The double rail is more efficient and humane than the V restrainer. V restrainers are rapidly being replaced with the double rail.

REFERENCES

DOUGLAS A.C., DARRE M.D. and KINSMAN, D.M, 1984. Sight restriction as a means of reducing stress during slaughter. In Proc. 30th European Meeting of Meat Research Workers, Bristol, England. pp. 10-11.

EDWARDS E., 1971. Apparatus for preparing animals for slaughter. U.S. Patent No. 3,599,276. Washington, D.C.

GIGER W., PRINCE R.P., WESTERVELT R.G. and KINSMAN D.M., 1977. Equipment for low stress small animal slaughter. Trans. ASAE, 20, 571-578.

GRANDIN T.,1983. System for handling cattle in large slaughter plants. ASAE Tech. Paper No. 83-4506.

GRANDIN T., 1987. High speed double rail restrainer for stunning or ritual slaughter. 33rd International Congress of Meat Science and Technology, Helsinki, Finland. Paper 3:1, pp. 101-109.

GRANDIN T., 1988a. Double rail restrainer conveyor for livestock handling. J. Agric. Eng. Res., 41, 327-338.

GRANDIN T., 1988b. Livestock handling preslaughter. Proc. Industry Day, 34th International Congress of Meat Science and Technology, CSIRO Meat Research Laboratory, Cannon Hill, Queensland, Australia.

SCHMIDT C.O., 1972. Cattle handling apparatus. U.S. Patent No. 3,657,767. Washington, D.C.

WESTERVELT R.G., KINSMAN D.M., PRINCE R.P. and GIGER W., 1976. Physiological stress measurement during slaughter of calves and lambs. J. Anim. Sci., 42, 831-837.

WILLEMS D.J. and MARKEY E.F., 1972. Animal shackling device. U.S. Patent No. 3,693,216. Washington, D.C.

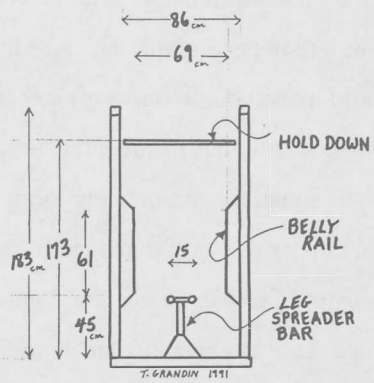

Figure 1. Cross section through restrainer entrance.

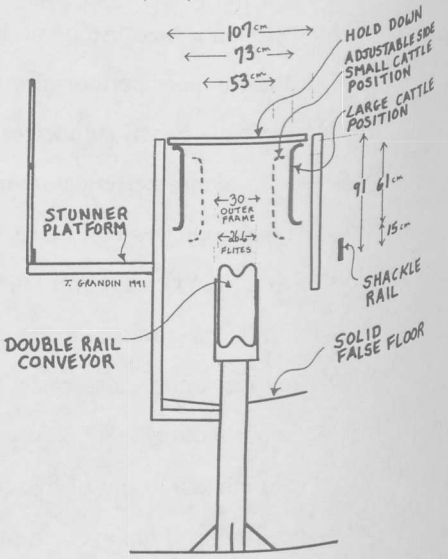

Figure 2. Cross section through restrainer hold-down

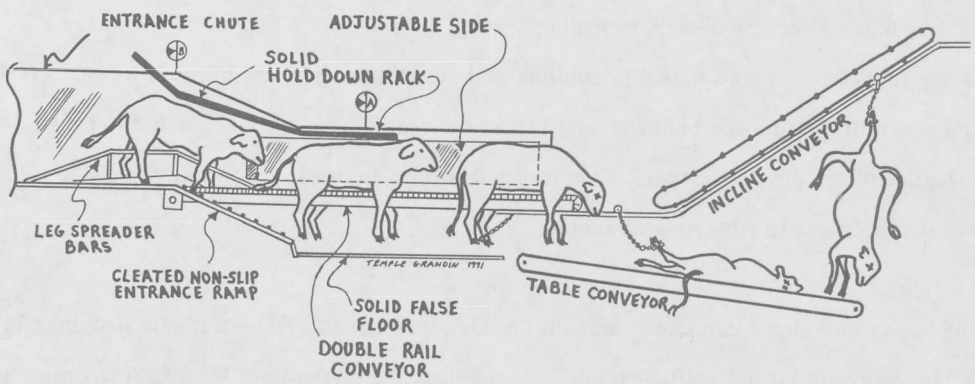

Figure 3. Side view of double rail restrainer

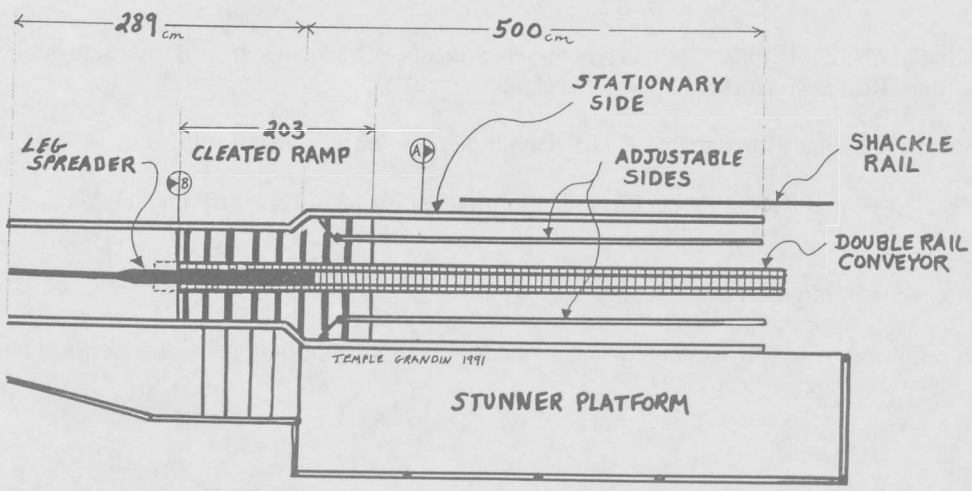

Figure 4. Top view of double rail restrainer