Silver Engineering's New Grab-Roll Beet Screen

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Changing harvest conditions have increased the demands on beet screens until it has become imperative to have a screen that is more effective with the large quantities of dirt, trash, and clods that we now receive.

Last spring several of you repeated your demands for a better method of cleaning beets. We, at Silver Engineering, went into a huddle and reviewed all that we knew of how to, and how not to screen beets and started experimenting again.

We made some crude models. We dug clods. We mixed mud. Great Western donated all the beets they could spare from their Longmont cellars. When we wore them out, we brought carrots and parsnips. We finally came up with a screen element which, under the conditions we could create in our shop, would do the job and which we were sure would do the job in the field.

Harvest was then in full swing in the Imperial Valley and Holly offered the use of their Heber dump. This dump had on it a double reverse Rienks screen. This Rienks screen was 60 inches wide and had 9 rolls, including 3 reversing rolls. We designed and built one of our new screens for it. We had to have one which we could put in over night so we had to compromise somewhat. The screen was both narrower and shorter than we would have liked, but it was a good trial unit.

This screen was installed June 30 and put to work the next day. At this dump they were receiving beets containing large quantities of moist, tough clods. Tables 1 and 2 show comparative data between the old screen and the new one under these cloddy conditions. You will note the tremendous improvement in the screening efficiency.

Union Sugar had also worked closely with us at Heber and they decided to install one of these new screens on their Sargent dump for the fall campaign. Since the two dumps were nearly identical, the screen for the Sargent dump was almost the same as the Heber screen. We made only a few small changes to incorporate some of the things we learned at Heber.

Table 1.—Heber, California. Comparison of Last Day of Operation of Old Screen with First Day of New Screen. Approximately 350,000 Pounds of Beets Each Day from the Same Field.

Gross Weight Beets	Old Screen 100	New Screen 100
Net Weight Clean Beets	76.55	81.04
Total Screenings Plus Tare	23.45	18.96
Tare	18.92	8.73
Attached Crowns and Tops	4.59	4.86
Total Possible Screenings	18.86	14.10
Actual Screenings	4.53	10.23
Screen Effectiveness	24.02%	72.55%

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Table 2.—Heber, California. Comparison of Screens with Approximately 2,000,000 Pounds of Beets Over New Screen and With Approximately 1,500,000 Pounds of Beets Over Old Screen.

Gross Weight Beets	Old Screen 100	New Screen 100
Net Weight Clean Beets	80.97	80.70
Total Screenings Plus Tare	19.03	19.30
Tare	14.08	9.96
Attached Crowns and Tops	4.86	4.84
Total Possible Screenings	14.17	14.46
Actual Screenings	4.95	9.34
Screen Effectiveness	34.93%	64.59%

Table 3.—Sargent, California. Comparison of Screens With Approximately 40,000,000 Pounds Over New Screen and Approximately 35,000,000 Pounds Over Old Screen.

Gross Weight Beets	Old Screen 100	New Screen 100
Net Weight Clean Beets	89.43	88.88
Total Screenings Plus Tare	10.57	11.12
Tare	7.67	5.72
Attached Crowns and Tops	4.47	4.44
Total Possible Screenings	6.10	6.68
Actual Screenings	2.90	5.40
Screen Effectiveness	47.54%	80.84%

The screen was installed about the middle of their harvest. Table 3 shows comparative data for the old and new screens at Sargent. These data cover all of the beets received during a three-month harvest season. Again, you will note the improvement in screening efficiency.

This new screen is composed of several rolls of Rienks kickers, all turning forward, followed by a series of grab-roll units. Figure 1 shows a standard screen arrangement. The Rienks rolls screen out the loose, easily-removed dirt and leaves the grab-rolls free to concentrate on the difficult material. They also spread the beets sideways. The first three rolls are rubber to assist the spreading. The last roll is steel to prevent the loss of beets between it and the first smooth roll.

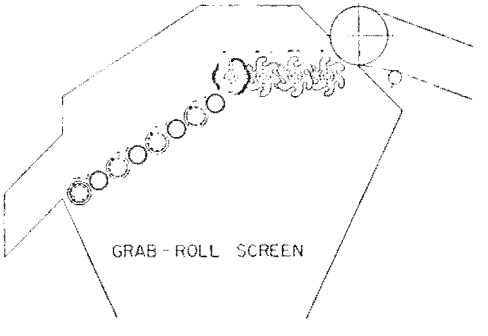

Figure 1. — Diagram of a standard screen arrangement.

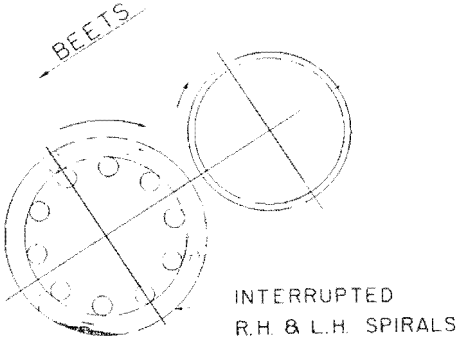

Figure 2. — Diagram of a grab-roll unit.

The grab-rolls are mounted on a slope and all turn upward against the flow of beets. A grab-roll unit is shown in Figure 2.

Practically all of the removal of foreign matter by the grab-rolls takes place through the opening above the cage roll. The corrugated-like surface of this roll plus the fact that it turns approximately four times the speed of the smooth roll tends to drag material into this opening. Material on which this roll can get a bite is immediately dragged through. The upward motion of the smooth roll controls the degree of bite to prevent damage to the beets. There is a selective action here between beets and foreign matter. The rolls will bite a clod, mud ball, or trash ball but not a beet.

A few beets will get tail-down into this opening. The controlling action of the smooth roll keeps them from being pinched, but even so they must then be removed or the screen will soon be plugged. This is accomplished by the spirals on the cage roll.

These spirals are in short sections and on each cage roll are alternately right hand and left hand. They are offset so that the adjacent runout points of the right and left hand sections are 180 degrees apart.

The beet that gets between the rolls is conveyed rapidly sideways by a spiral. When this spiral runs out, the beet overtravels and the opposing spiral strikes it to throw it back. With a beet the center of mass is well above the rolls. This means that the spiral strikes it below its center which flips the beet upside down and out of the rolls.

Again, there are selective actions here. Any piece of foreign matter which is too big to be pulled through at the first bite will also be caught by the spiral, but this cannot be conveyed sideways as easily as a beet; thus, there is a chance that the spiral will break it or drag it through. If it is not broken, it will be conveyed sideways by the spiral the same as a beet; but unlike the beet its center of gravity is low so that when the opposing spiral strikes it, the blow will drive it straight back along the roll and not flip it out.

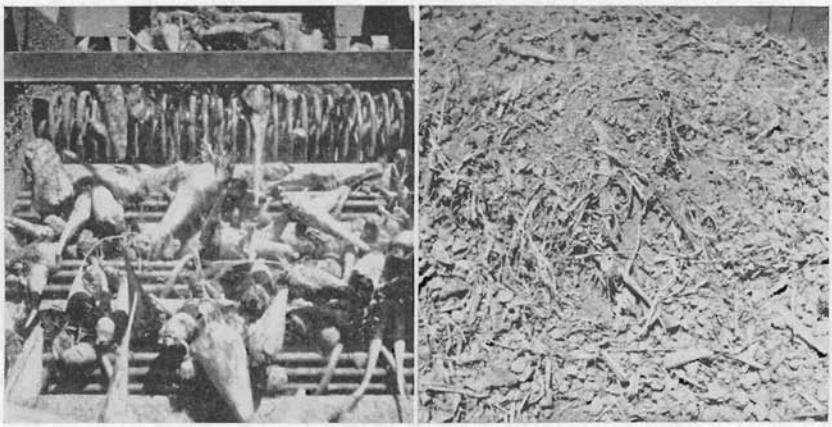

Figure 3.—Beets and clods on a grab-roll screen at Herber, California, are shown at the left and screenings from a grab-roll screen are shown on the right.

These actions result in dirt, clods, trash, etc., being held next to the rolls until they are broken up and taken through while beets dance on over the screen.

This year we designed a 42-inch piler. The design was new from the ground up. We reviewed every part of it, every detail, every function. We incorporated every improvement that would make it more convenient, faster and more effective. These included open construction for greater accessibility, hydraulic dumping strut, hydraulic platform and piler lifting, hydraulic steering, more complete and direct dirt recovery, automatic tare-taker, power boom raising, power boom swinging and automatic oscillation and, of course, a grab-roll screen.

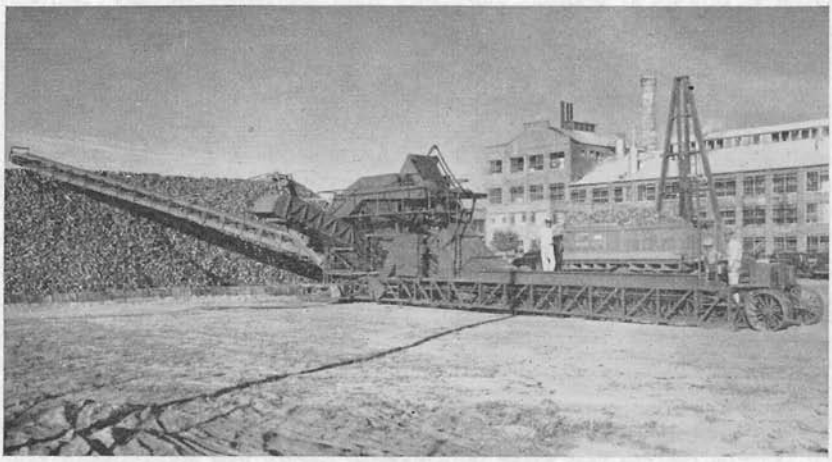

Figure 4.—Forty-two inch piler at Tracy, California.

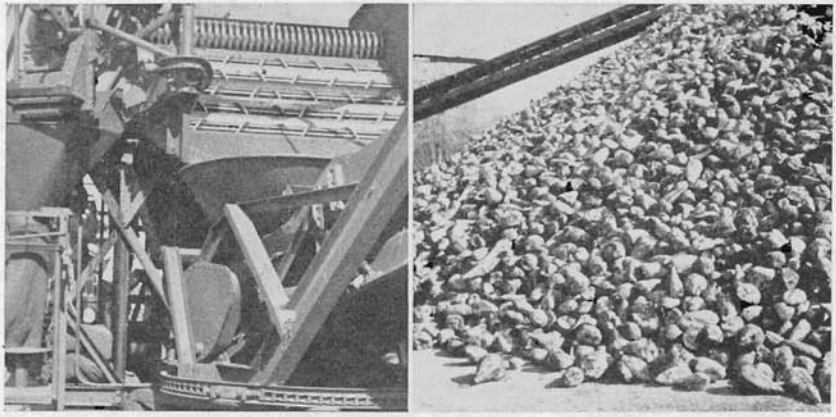

Figure 5.—A grab-roll screen on a 42-inch piler shown on the left and a beet pile at Tracy, California, from a 42-inch piler shown on the right.

This screen was 90 inches wide and consisted of 7 Rienks rolls and 5 sets of grab-rolls.

The first piler of this design is in the factory yard of the Holly Sugar Corporation at Tracy, California. Many of you have seen it. During the early part of its operation, before it started to rain, they were able to restrict their piling to just the cleanest loads. Table 4 shows the screen performance on approximately 1,750,000 pounds of the beets handled during this dry weather. You will note that the screen removed 87.83 percent of the removable material. There is no question in my mind but that the pile put up with this piler was the cleanest pile ever put up with mechanically harvested beets.

After it started to rain, they increased the speed of the harvest to finish as quickly as possible; thus, they took beets over the piler without selection.

This was our first field experience with muddy beets. We had tried mud in the shop and found no difficulty. There had been enough moisture at Heber to cause some dirt to stick to the rolls. In both cases we found that the differential speed between the two rolls had a cleaning action that limited buildup. Nevertheless, we were anxious to try really muddy beets and at last our hopes were realized.

There had been some loose mud balls forming inside the cage rolls. When we got into the mud, these rolls filled up solid and then quit building. Very little mud stuck to the smooth rolls, but, where it did stick, the kneading action of the spiral on the cage roll caused it to peel off. No cleaning was necessary and the screening action was as good as ever. There was some excessive buildup in the Rienks kickers and they required some cleaning.

During the last two weeks in November, Tracy had .84 inches of rain. Table 4 shows the screen performance on approximately 2,000,000 pounds

of beets handled during that time. You will note that even under these conditions the screen still removed 75.25 percent of the removable foreign matter.

The Heber and Sargent screens had 4 Rienks rolls and 3 sets of grab-rolls. The Tracy screen had 7 Rienks rolls and 5 sets of grab-rolls. After observing these screens, taking into account their performance with trash, clods, and mud, and considering construction costs, we believe the standard screen should have 4 Rienks rolls and 4 sets of grab-rolls as shown in Figure 1. A screen for a 42-inch conveyor should be 90 inches wide; for a 36-inch conveyor—72 inches wide; and for a 30-inch conveyor—60 inches wide.

This grab-roll screen has demonstrated that with tough clods it will break them and screen them out. It has demonstrated that it will remove large quantities of trash—even clumps of weed roots. It has also demonstrated an ability to cope with sticky mud.

We, at Silver Engineering, are proud of it and confident that it will go a long way toward meeting your demands.

Table 4.—Tracy, California. 42-Inch Piler Screening Results on Approximately 1,750,000 Pounds of Beets During Dry Weather.

Gross Weight Beets	100
Net Weight Clean Beets	97.33
Total Screenings Plus Tare	7.91
Tare	5.23
Attached Crowns and Tops	4.87
Total Possible Screenings	3.04
Actual Screenings	2.67
Screen Effectiveness	87.83%

Table 5.—Tracy, California. 42-Inch Piler Screening Results on Approximately 2,000,000 Pounds of Beets During 2 Weeks of Rainy Weather.

Gross Weight Beets	100
Net Weight Clean Beets	80.86
Total Screenings Plus Tare	19.14
Tare	10.11
Attached Crowns and Tops	7.14
Total Possible Screenings	12.00
Actual Screenings	9.03
Screen Effectiveness	75.25%