

2019 YOU SHOW US CONTEST
Spring Load Arm Enhancement
for
Gravel Saver Disc

COUNTY: LaMoure County Highway Department

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PROBLEM STATEMENT: The gravel saver disc which bolts to the moldboard of the motor grader will sometimes hit a rock or other solid object. The disc does not flex. Because it does not flex, the hub on which it rotates would sometimes crack or break.

Tines on the back of the gravel saver disc are designed to pull the vegetation, which was cut loose by the disc, through the disc and the moldboard. When the vegetation is heavy, it tends to build up and completely plug the area between the disc and moldboard. This causes the tines to frequently break.

SOLUTION: A team of two, designed and built the spring-load arm enhancement for the gravel saver disc. The gravel saver disc is an innovation designed and fabricated previously in another state. The spring load arm enhancement allows the gravel saver disc to flex when hitting a rock or other solid object.

The flexing action of the arm allows vegetation to flow more freely and keeps the disc rolling. Fewer stops are needed for cleaning vegetation buildup from between the moldboard and gravel saver disc. The bushing on the arm and the bushing on the bracket are each angled at 5 degrees. This helps the gravel flow into the moldboard without sloughing off the toe. The 10-degree angle also prevents the moldboard from creating a ridge on the roadside so proper drainage is maintained and there is no loss of gravel. The angle iron welded to the disc's mounting bracket also keeps the disc from flexing down too far and also serves as an arm rest.

When conditions are right, the gravel saver disc with the spring-load arm enhancement allows the operator to square up the moldboard enough to reduce the number of passes by the motor grader from three to two passes.

The spring-load arm enhancement makes it easier for the operator of the motor grader to use the gravel saver disc. The spring load arm enhancement has greatly improved efficiencies. Breakdowns are non-existent, fewer passes with the motor grader over the road are required, vegetation clumping is almost nonexistent, gravel is pulled back on the road and proper drainage is maintained.

LABOR, EQUIPMENT, AND MATERIAL:

Equipment used:

Drill
Welder
Torch for heating

Salvage material:

1 - Spring tooth from farm harrow
2 - Angle iron 1-1/2" x 1-1/2" x 1/4" x 5-1/4"
(welded to gravel saver bracket and notched to allow flexing of the arm)

New material:

Rectangular tubing – 4" x 2" x 3/16" x 10"
1 DOM (Seamless) bushing 2-3/8" x 5" machined to fit for 1-3/4" shaft
1 DOM bushing 2-3/8" x 2-1/2" machined to fit for 1-3/4" shaft of the gravel saver disc
1 Shaft: 1-3/4" x 10" Drilled with hole to accept 9/16" retaining bolt when inserted from the back of the bracket. The back end of the shaft may need to be machined to accept the spring coil of the harrow tooth and drilled for retainer bolt
1 Large flat washer for between coil spring and bushing welded into the arm
Grease zerk inserted into the bushing with the shaft
Bolts 2 - 9/16 x 3" bolts, one to pin the arm to the bracket and one the disc to the arm
1 - 3/8" x 2-3/4" w/ washers and nut: 1/2" nut welded to the head to retain the tooth of the spring
1 - 1/2" x 3" with washers to hold coil of the spring

Total Labor Hours

2 people
1 person – design and discuss: 3 hours
1 person - fabricate: 5 to 7 hours

COST SUMMARY:

Total Cost: \$300 (materials and labor)

SAVINGS AND BENEFITS:

The motor grader operator is able to grade a road in two-thirds of the time. In other words, what previously took one hour on a road segment now takes 40 minutes. The county has been using the spring load arm enhancement for the gravel saver disc for over a year. Since then, the hub has not cracked and the tines have not broken on the gravel saver disc. The spring-load arm enhancement has totally eliminated breakdown time for the gravel saver disc attachment. There are no longer costs to repair the hub and tines. Also, fewer stops are required to remove compacted vegetation from between the gravel saver and the moldboard.

The county has experienced savings in time and money, and has seen an increase in the efficiency of the gravel saver disc. The motoring public reaps the safety benefits of traveling on a road that is completely graded in a shorter period of time.

ANNUAL OPERATING COSTS:

Prior to using the innovation –

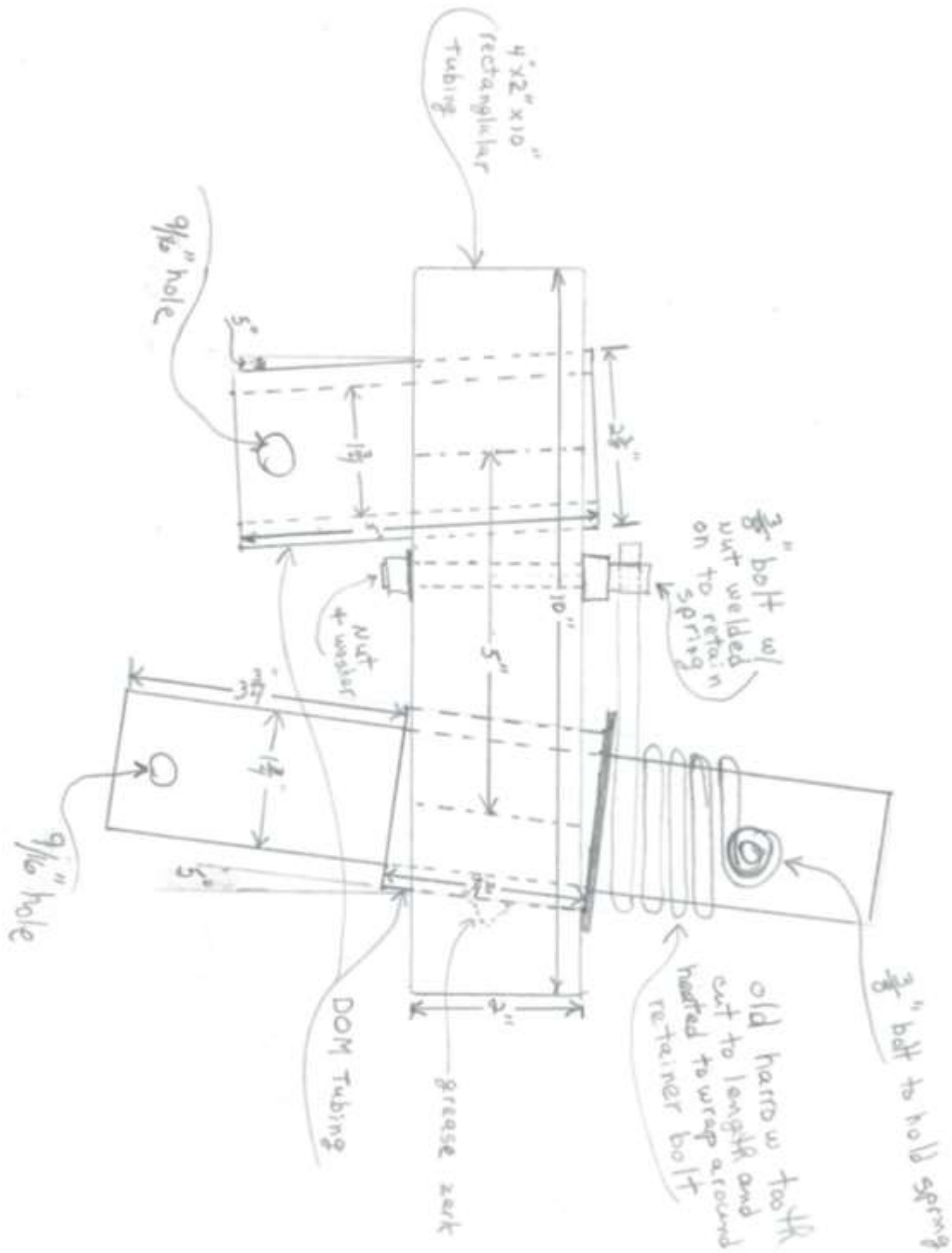
When the hub or the tines on the gravel saver disc would crack or break, there was a cost in time and money to repair these components. When the operator was unable to use the gravel saver disc more gravel was left on the roadside or a ridge was created on the roadside because the blade had to be more angled. This can cause the side of the road to be soft or eroded due to ineffective water drainage. Typically a maintainer must pass over a wider road three times. These all impose increased time and costs for county.

After using the innovation –

With the spring-load arm enhancement on the gravel saver disc, the hub or tines have not cracked or broken. The likelihood of a ridge is almost non-existent, so water drainage is more effective and the road sides are solid. The motor grader operator passes over certain roads with the maintainer twice verses three times. These are all cost savings to the county in time, money and workforce. Also, the road is safer for the motoring public because roads are improved and are graded in a shorter period of time.

DRAWING (SCHEMATIC) WITH DETAIL:

Dimensions are nominal to give proper clearance for ease of assembly.



Spring-loaded arm.



Spring-load arm attached (view from back side of bracket).



Spring-load arm attached (view from front side of bracket).



Spring-load arm with gravel saver disc attached.



Flexing action of spring-load arm.



Gravel saver disc without Spring Load Arm Enhancement



Spring-load arm rest prevents disc from flexing to far down.



Angle iron rest for spring-loaded arm which is notched to allow for flexing. The rest is welded to gravel saver bracket.



Bushings on spring-load arm and on bracket are each at a 5-degree angle.



Bushing on bracket is angled at 5 degrees.



Spring tooth held by 3/8-inch bolts.



Rectangular tubing, grease zerk, spring tooth, 3/8-inch bolt, and 1 3/4-inch shaft.



Hub and tines.



One pass on road using spring-load arm with gravel saver disc.



Video:



Spring Load Arm Enhancement video - 1 min.mp4

<https://drive.google.com/a/ndsu.edu/file/d/1SCMzeWbP-fVZGAMb1urikF4yIxlQGJqr/view?usp=sharing>