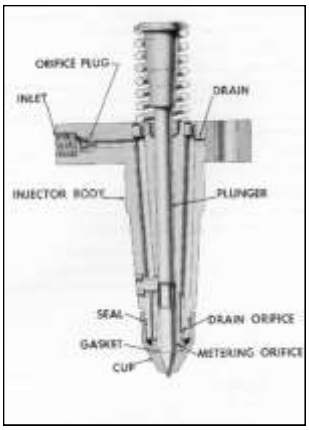
Cummins Fuel Injection Systems (continued)

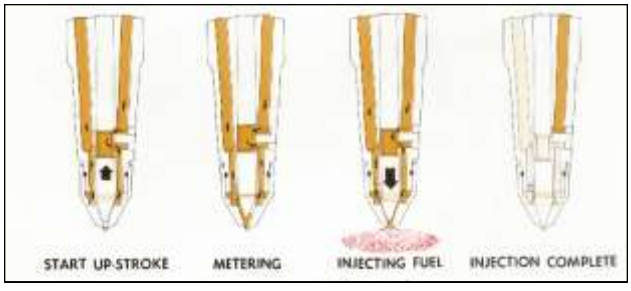
Winter 2013 Newsletter

Injectors



The fuel injector is mounted in the cylinder head above each cylinder and is an integral part of the fuel system. As such, a brief review is warranted. The injector is mechanically operated from the camshaft through rocker levers and a push rod (see Fig. 9). The length of the stroke of the injector plunger remains constant at all speeds. The injector cup is mounted on the end of the injector. During the compression stroke, the fuel metering pump forces a charge of fuel of the exact amount for the load and speed of the engine into the injector cup. After the piston starts upward on the compression stroke, hot air is forced through the small spray holes in the injector cup. The fuel in the cup is exposed to intense heat and pressure and thus is preheated and completely dispersed. A few degrees before top dead center, the plunger is forced down and the preheated fuel charge is forced out through the six (seven in the NH) small holes of the injector cup into the cylinder (Fig. 10). These holes are only a few thousands of an inch in diameter and the fuel is completely broken up and distributed as a spray through the compressed air at the top of the cylinder.

Air temperatures here reach approximately 1000°F. and the highly combustible fuel charge ignites and forces the piston downward on its power stroke. The injector plunger continues it's down stroke during the first part of the power stroke and remains in the lowest position until the start of the exhaust stroke. A small check valve is located in the lower end of the fuel passage in the injector body to prevent fuel from being blown back and filling the fuel lines with air.



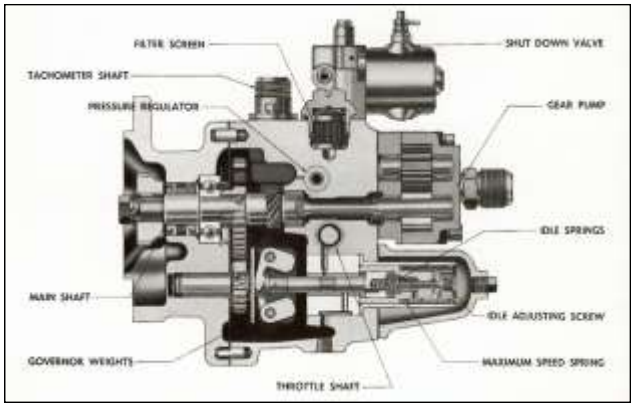
The double disk pump was lighter than its single disk predecessor but was extremely complicated and very expensive to manufacture. Both material and manufacturing costs were well above those of the single disk pump. It was also claimed to be easier to maintain based on its new design which incorporated a unit-replaceable pressure pump, governor assembly and distributor disks. By early 1950, Cummins was offering the double disk pump as standard equipment on several models. Unfortunately, the pump was plagued with mechanical problems including chronic leakage.

The disk based fuel systems served the Cummins Company very well from the 1930's to the early 1950's. However, these disk-based systems shared a fundamental mechanical limitation in that neither could operate at very high speeds under high pressure (200 psi was max for the DD pump). This tended to limit rpm and horsepower. By the end of the 1954 model year, double disk pump manufacturing was brought to a close.

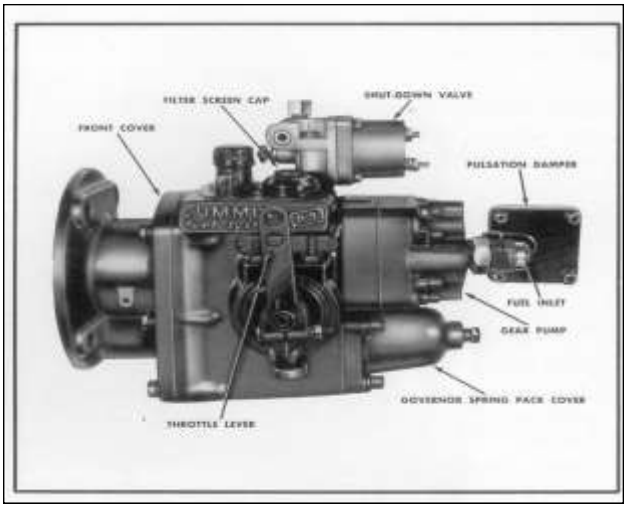
- *New Photos posted in the gallery section*
- *Trucks from AUS coming soon*
- *Download show registration for the best antique truck show in the world in "Truck Shows & Flea Markets"*
- *New Photos from the Procter story coming in the next issue.*

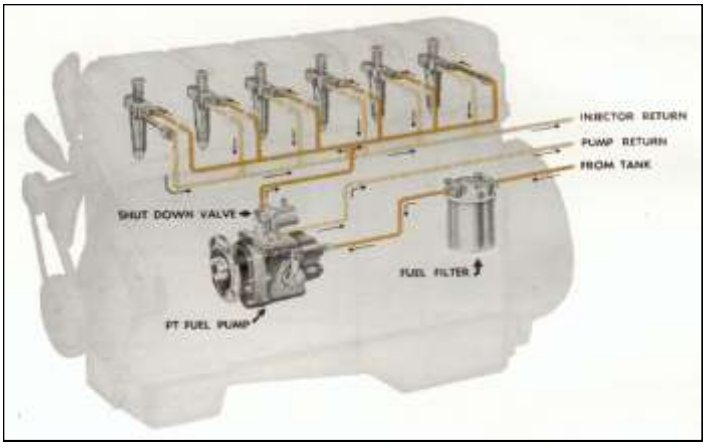
Inside this issue:

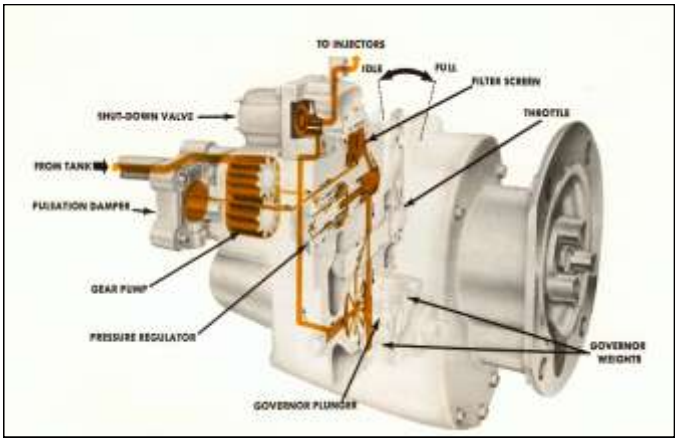
The PT Fuel System



The invention and commercialization of the double disk pump system overlapped with the development of an alternative fuel system and injection technology known as the PT or pressure-time system. Whereas the double disk system was patterned after the single disk system, the PT system was a radical departure (see Figs to the right). The principle of the PT system was based on the fact that by changing the pressure of a liquid flowing through a pipe, the amount of liquid coming out of the open end could also be changed. Increasing the pressure increases the flow or the amount of liquid delivered and vice versa. The PT fuel pump supplied fuel at low pressure to a common rail where it was distributed uniformly to all cylinders and then injected at high pressure by a small mechanically driven plunger within each cylinder head. This new PT pump was a lot smaller and much simpler than its much heavier and more complex predecessors. It was also more producible, predictable and practical than the earlier SD and DD fuel pumps. This breakthrough in fuel pump design and performance had really advanced the state of the art and could not have come at a better time for Cummins considering some of the problems that had plagued earlier fuel systems. It was also considerably cheaper to manufacture because of its mechanical simplicity. The PT pump had only 148 parts compared to 415 parts for the SD and 448 parts for the DD pump. Manufacturing costs averaged $143 per PT pump while the SD pump was $268 to produce and the DD pump cost $325 per unit (Cruikshank and Sicilia, 1997). By the end of 1953, more than 400 units had been manufactured. Another great advantage of the PT pump was that it could be retrofitted on every Cummins engine manufactured since 1932. Not surprisingly, the PT pump quickly emerged as one of the most popular and successful diesel engine components in many years.







Here's a link to the fabulous Tackaberry Collection in Athens, Ontario.

http://6one3.smugmug.com/Other/Tackaberry-Tour-October-24/14351143_36bhG#!i=1062612836&k=ezkdh

"Big Henry", Hendrickson Ultra-Prime Mover

The cost of Big Henry was approximately $100,000 in 1963 dollars which must have been a considerable sum in its day!

Heavy hauls, also called overweight shipments, require considerably more care than typical load and go transports. Safety to other motorists on the road is a major concern. Loading and unloading the haul often takes specialized equipment most fleets don't invest in. Because of these specialized needs, this was seen as a profitable business model to pursue in the early 1960's by the Higgins Erectors and Heavy Haul specialists originally from Buffalo, NY but now located in Niagara Falls .

Big Henry resulted from a specification for an idealized prime mover drawn up by Norman Weiler, chief engineer of rigging, hauler and erection operations. He joined Higgins in 1958, five years before Big Henry was produced. Interviewed personally by AVT staff a few weeks ago, Mr. Weiler has been retired for several years but he retains fond memories of the design and production of this very unique ultra heavy-haul truck. Many of the photos to be used in this newsletter and future publications were generously provided by Mr. Weiler.

The specification for Big Henry was the outcome of rigorous assessments of what equipment would secure Higgins a clear competitive advantage in the near future. A review of the opportunities in an ever-changing marketplace included the prospect of heavier loads from new generations of machinery required by the manufacturing industry, process plant and particularly, power generation.

The needs of the Niagara Falls hydroelectric installations were well known at the time. Anticipated crane and trailer developments were also factors as were the beginnings of a growing reluctance by the rail freight sector to accept the disruption caused by moving oversized loads. "We looked at the various US heavy prime movers catalogued at that time" says Norman Weiler. "We talked to the usual suspects about developments they might have in the pipeline and the scope for customizing. Nothing matched our requirements –and there was no interest at any price in purpose-building

"There was no interest at any price in purpose-building a rig. Hendrickson Manufacturing, Chicago, was the lone exception. Hendrickson's engineers understood what we wanted. We quickly formed a close working relationship".

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The result was the one and only Hendrickson model BDF-1860-F20. Specification changes made along the way included a switch from the initial idea of having a double frame which carried the risk of delamination in extreme load conditions. Corrosion would also be an issue. Instead, the decision was made to construct the chassis with 14 inch deep T1 steel I-beams with eight inch wide top and bottom flanges.

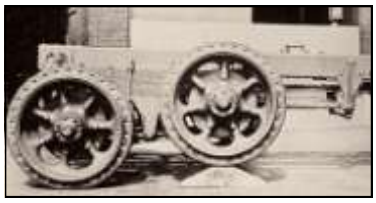
The twin-steer long-hood layout distinguishes Big Henry from any other Hendrickson-and almost every other truck in the world. The tandem front axles ensure weight is distributed so that, whether operating in fifth wheel or ballasted tow bar configuration, optimal steering effort is ensured regardless of the load imposed on the chassis. The engine is a Cummins NVH-525, a 1710 cubic inch (28 liters) V12 diesel developing a maximum output of 525 BHP at 2100 rpm. Maximum torque is 1443 ft lbs at 1475 rpm. The cooling system incorporates a 44-inch diameter fan and Kysor shutters. The high/low range transmission comprises an Allison CL8T-5960 six-speed constant mesh Torqmatic with full power shifting and automatic lock-up in all gears and a 3 speed Cotta auxiliary. The torque converter incorporates a Chelsea PTO.

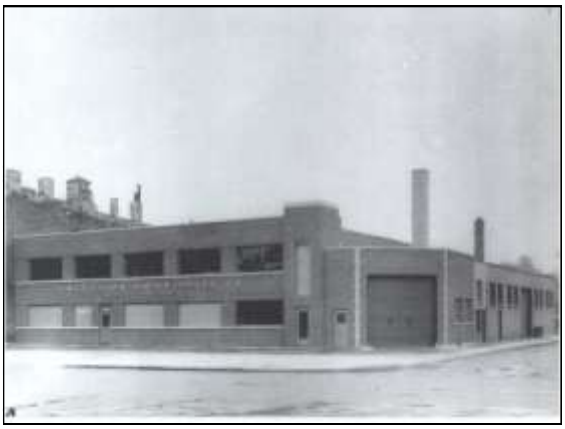
Drive axles are planetary double-reduction Rockwell SPR-700's with thrust bearing type Spicer main and inter-axle propeller shafts. The drive axles are mounted on a rubber-bushed 75 ton capacity Hendrickson walking beam unit; the bogie has leaf-spring cushioning and is mounted directly under, rather than from the side of the frame members.

With a combined capacity of 40 tons, the tandem tubular-type Shuler front axles equipped with Garrison power steering are carried on Hendrickson RT-365 leaf-spring suspension units. Brakes are 17.25 x 4 inch drums all round at the front and 20.25 x 5 inch drums on the drive axles, supplemented by a drum brake on the rear of the auxiliary gear box. Tires are 16.00 x 25, 24 ply. The capacity of the left side fuel tank is 100 US gallons. The 9 inch drum Braden winch has a rated capacity of 50 tons.

Brief History of Hendrickson

The Hendrickson story began in 1913 with the founding of The Hendrickson Motor Truck Company by inventor and businessman Magnus Hendrickson pictured at left and below. This small Chicago-based manufacturing company built trucks often equipped with cranes, which were used to haul stone and other building materials. In 1926, Hendrickson introduced the first tandem truck suspension, which mounted the axles on each end of an equalizing beam. This unique "walking beam" design distributed the truck's load evenly between the two rear axles, which improved traction and greatly reduced the effects of bumps and potholes in the road. The walking beam soon gained widespread acceptance among the industry's new 6x4 "six wheeler" trucks, which allowed more payload. In 1978, The Boler Company, whose holdings included manufacturers of leaf springs and metal bumpers, purchased Hendrickson. In the years that followed, Hendrickson would expand into or acquire additional businesses in related areas—trailer suspension systems, auxiliary axle systems, springs, metal bumpers, and other heavy-duty components. Eventually Hendrickson sold the truck manufacturing operation to focus solely on suspension systems and related components.





To Be Continued

New T-Shirts!!!

These T-shirts are based on a Gildan ultra-cotton high quality blank that will not shrink and is cut just slightly larger than the standard sizes to accommodate any extra curves that one may have.

Learn more....

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All Vintage Trucks Calendar

A new calendar is available based on several antique Mack Truck ads. These are nostalgic and very colorful. Some months are pictured below-available for purchase online in the Miscellaneous section of the AVT web site.

Very rare parts books available only from www.allvintagetrucks.com/products-1/service-and-maintenance-manuals

Rare Parts Books for Mack B-61T, Mack B-81 and Mack LT Series Trucks. Also Service Manual shown for Mack B-813SX. These are just some examples of the many Parts Books and Service Manuals available on the All Vintage Truck web site to assist you in the restoration and repair of your antique truck.

Old Gas Stations-some pics and a link http://hipspics.freewebspace.com/gas/gas.html