ADVENTURES OF A MECHANIC

by Reuben Epp

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Reuben Epp is known internationally for his expertise in the Low German language but he earned his living by his profession as a master mechanic and teacher. These twenty essays illustrate his fascination with his profession and demonstrate his natural abilities as a good writer. We have many stories of Mennonites as farmers it is overdue that we also have stories of other occupations in which Mennonites laboured.

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ADVENTURES OF A MECHANIC

by Reuben Epp

The Frozen Airline (by Reuben Epp - 2002)

It was during the winter of 1955-56, while we were living in Port McNeill near the north end of Vancouver Island, where I was employed as a mechanic in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company, when I was approached by our shop foreman with a special request. Although he at first hesitated to ask, he requested that I dig down to the airline that crossed underneath the gravel road uphill from our shop. The airline ran downhill from the power plant and air compressor, crossing horizontally underneath a gravel road and from there to our shop to supply it with compressed air. The cold weather of that winter had solidly frozen the road with the airline buried in it. Condensed water in that part of the line was also frozen, cutting off our supply of compressed air to the main mechanical maintenance shop.

Something had to be done immediately because some functions in the shop could not be carried out without compressed air. The solution that our foreman saw was to pickaxe down to the pipeline and to thaw it out. That was not easy to do when the hard-packed gravel roadbed was frozen solid and the pipeline was buried in it at a depth of a foot or more.

Nonetheless, I proceeded to do as requested because I had respect for the foreman and he readily acknowledged that I was really not hired as a ditch-digger but as a mechanic. I went to the tool shed, got a pickaxe and prepared myself to attack the dig. Before doing so, I opened the airline valve in the shop and listened at its open end. I could hear a whisper of air coming through from the compressor. I left the valve open and proceeded uphill to the air compressor, tracing the pipeline from there down toward the trouble spot under the frozen road. I found a union in the pipeline not far downhill from the compressor.

A work-saving plan of action came to mind. I returned to the shop and got my pipe wrenches and a quart can which I partially filled with methyl hydrate from a barrel in the fuel shed. I then shut off the air valve at the compressor, opened the union in the pipe and poured in the methyl hydrate.

Then I reconnected the pipeline, opened the valve at the compressor and returned to my assigned task of digging the frozen gravel roadbed.. I did not dig long. I think it was about ten minutes later when I heard a loud shout in the shop, "Shut that damn thing off!" I smiled inwardly and continued to dig obediently. Then my co-worker Shorty came out of the shop door and called to me, "Hey, you can quit digging and come back to the shop. The airline is OK now." I had by then hardly made a mark on the road. I shouldered pickaxe and tools and returned to the shop, pretending surprise at being relieved of the digging job. When I asked what had happened, Shorty explained, "The airline suddenly let go with a blast that smelled like a bloody brewery."

I put the tools away and returned to repairing logging equipment, satisfied that laziness, with maybe a little cunning, had once more paid off.

The shop foreman came by not long thereafter with a knowing smirk on his face but without any further comment!
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Removing Dowels -- Without making Marks (by Reuben Epp - 2002)

On one occasion in 1956 when we were living in Port McNeill near the north end of Vancouver Island, where I was employed as a mechanic in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company, I was approached by our shop foreman with a special request.

He carried in his hands a rather large aluminum casting from a machine undergoing repairs in our shop. Since the repair job on the machine required a change in reassembling the parts, two dowels in the face of the casting needed to be removed. The face of the casting in which the dowels were installed was a finely-finished flat aluminum surface.

The dowels consisted of short lengths of polished steel rod, ½ inch in diameter, driven into holes drilled in the face of the casting, but not all the way through it. Such a hole is usually termed a 'blind hole.' Therefore, the dowels could not be removed by punching them out from the opposite side. The foreman explained to me that the dowels needed to be removed without leaving so much as a visible mark on the smooth surface of the polished aluminum. He asked me whether I could do it, after reminding me again that he wanted absolutely no marks of any kind on the surface of the aluminum casting. I realized what he was asking of me, and also knew that the smooth aluminum surface would be readily marked, therefore would need to be protected against contact with any hard object Having had previous experience with removing pilot bushings from the blind holes in the ends of engine crankshafts, I was confident that I could employ a similar technique to remove the steel dowels as requested. After examining the casting carefully, I explained to him that I was confident that I could remove the dowels without leaving a mark of any kind. When he asked how I would accomplish this, I replied that I would first fasten a sheet of heavy cardboard over the face of the casting, leaving only the ends of the dowels exposed. Then I would remove each dowel by applying hydraulic pressure to its bottom end in the hole. Since there was no apparent way of getting at that end of the dowel, he was perplexed as to how I would achieve this. I explained that I would drill a hole lengthwise through the axis of each dowel and apply hydraulic pressure through the drilled hole. Without fully understanding what I had in mind, he reluctantly agreed to let me try my method, reminding me again, "Remember, no marks!" I invited him to watch. With the protective cardboard in place, I carefully marked the exact centre of each dowel with a centre punch. Then I placed the casting on the drill press table, dowels facing up, and drilled through the centre of each dowel, with a drill bit slightly less than ⅜ inch in diameter.

Then I took a bolt of ⅜ inch in diameter and cut off its threaded end, leaving me with a smooth ⅜ inch plunger with a bolt head on one end. I then drilled again with slightly larger drill bits, increasing incrementally in size until I could just barely insert my makeshift ⅜ inch plunger all the way through the centre of each dowel. Then I placed the aluminum casting on my workbench with the cardboard covering and dowels facing up. There, I used an oilcan to fill the holes in the dowels with fairly viscous oil of about #40 weight. Then I dipped a little oil from each hole so I could insert the end of my plunger into the drilled opening, leaving the plunger standing upright in the hole. Then it was simply a matter of grasping the plunger in a gloved hand and tapping the end of it with a hammer, driving it against the oil all the way to the bottom of the hole. I then pulled out the plunger, refilled the hole with oil and repeated the process. With each repeated stroke of the plunger, the dowel was forced ever so slightly but perceptively from its hole. Finally, on the last stroke, the dowel fell free in my hand. The polished face of the aluminum casting had not been touched with anything other than cardboard and a little oil. Naturally, the shop foreman was delighted. He thanked me and carried away the casting, shaking his head!
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The Coast Enterprise - Engine Problems (by Reuben Epp - 2002)

The year was 1956 and we were living in Port McNeill near the north end of Vancouver Island where I was employed as a mechanic in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company. Since the village of Port McNeill at that time was quite isolated and without roads to most surrounding communities, people living and working there depended upon water transport for supplies and travel. One of the boats serving Port McNeill, Sointula and Alert Bay and other villages was the Coast Enterprise, run and owned by Bill Graham. This wooden vessel, which had once been a rather stately yacht, was by then in rundown condition, especially its Superior diesel engine. For more than a year the engine had been running on 7 of its 8 cylinders due to a worn-out camshaft.

When the deteriorating condition of the engine finally forced Mr. Graham to consider an overhaul, he made a deal with management at Pioneer Timber Company to hire his own mechanic whose name was Joe and to use the company's shop facilities for the needed repairs to the 8 cylinder in-line Superior diesel engine. Since Graham was short on money, he was fortunate in finding a war surplus firm in Seattle where he could buy all the parts he needed to overhaul his engine at low prices. Although I was not at first involved in the overhaul because this engine was not company equipment, I observed the engine being lifted from the boat and being brought to our company shop where it was placed in an auxiliary building near the main shop. I saw Joe dismantling the engine, cleaning components and selecting replacement parts from among those that Graham had obtained in Seattle. I occasionally chatted with Joe at that time and was impressed that he seemed to know what he was undertaking. However, one day when the engine was about half restored, Joe suddenly disappeared from the scene for reasons unknown to me. Mr. Graham was left with his boat engine in pieces in one of our shops with no one to finish the job of putting it together.

Shortly thereafter my shop foreman came to me and asked whether I would undertake finishing the overhaul job on Graham's engine while on Pioneer's payroll. If there is a way of making a mechanic feel uncomfortable, it is by asking him to finish a repair job left unfinished by someone else. With great hesitation and foreboding, I finally accepted the assignment, but only after receiving assurance from my supervisor that I could thoroughly inspect the job as completed thus far and to make corrections as I deemed necessary.

Among the troubling items that I discovered was the fact that the worn camshaft that had contributed to the need for the overhaul in the first place, had been reinstalled in the engine while a perfectly good camshaft stood among other parts from Seattle in a corner of the shop. The engine flywheel with its badly worn starter ring gear had not been replaced with the new one among the Seattle parts. Since Graham came around frequently to observe the progress of work on his engine, I questioned him about these points of concern. He explained that the reason for the old camshaft not being replaced was that the intended new replacement was built for a firing order differing from that of the old camshaft and was therefore not synchronized with the firing sequence of the engine's fuel injection pump. And he could not afford to change the injection pump. He further explained that the flywheel had not been replaced because it was built for an engine of opposite rotation, thus rendering useless all existing timing marks needed to time the engine's fuel injection pump.

With this information, I set about finding alternatives to the problems, knowing that it would be foolish of me to continue with the job as it had proceeded thus far. I discovered that the firing order of the new camshaft was in fact different from that of the old shaft in the engine. But, it differed only inasmuch as that the firing sequence of cylinders number 4 and 5 had been interchanged. Since the pistons of these two adjoining cylinders moved together, but were fired on alternate revolutions of the engine, I reasoned that change in the engine's firing order incurred by the new camshaft could be accommodated by simply crossing fuel injection lines to these two cylinders. Number 4 plunger of the injection pump would then inject into number 5 cylinder and number 5 plunger would inject into number 4 cylinder, thereby synchronizing the sequence of injections from the fuel injection pump with the firing order of the engine as determined by the new camshaft.

Upon examining the new flywheel I found that it was indeed a good replacement for the old one whose ring gear was worn out, but since it had been built for an engine of opposite rotation, all timing marks on it were wrong for this engine. Because I had a good grasp of the mechanical and mathematical principles involved in placing timing marks, I felt confident that I could overcome the timing mark problem by careful geometric layout to determine exact locations for inscribing new timing marks as specified in the engine manual. My next problem was to convince Mr. Graham of the seriousness of these unsolved engine problems and, furthermore, that I could solve them, and that it would be futile not to correct the camshaft and flywheel problems when the parts needed for their solution were on hand. I remember that it took some time and argument to convince him that I could solve these problems because he had totally accepted what Joe had said about the impossibility of using the new camshaft without a new or rebuilt fuel injection pump. It took some time to convince him that I had the answers and that I should be permitted to apply them. After some time, during which he probably consulted with other mechanical people, he reluctantly agreed to let me go ahead with the engine job as I had suggested.

One of the first items I addressed was the placement of new timing marks on the new flywheel. As I remember it, timing of the injection pump was coordinated with a mark on the old flywheel which indicated 12 degrees before top dead centre of number 1 piston. To determine the exact location of 12 degrees before top dead centre, I first had to find and mark top dead centre. This I did by fastening a metal rod into the injector opening of that cylinder, extending just far enough into the cylinder to touch the piston as it neared the top. I then rotated the engine by hand until it came to a stop against the end of the rod. In that position I carefully inscribed a small mark on the rim of the flywheel opposite a reference point on the housing. Then I rotated the engine in the opposite direction until the piston again touched the rod. This determined the location of the second small mark. Top dead centre had to be exactly half way between these two marks. After carefully measuring and marking the halfway point, I removed the rod from the injector opening and rotated the engine to top dead centre as indicated by my mark. In that position I permanently stamped the flywheel through the timing inspection opening with the customary mark: TDC.

Locating the timing mark for the fuel injection pump at 12 degrees before top dead centre was easy. Assuming that the ring gear on the flywheel had 120 teeth, the distance from tip to tip between two adjoining teeth represented exactly 3 degrees of a full 360 degree circle. Consequently, I rotated the engine backward the distance of 4 spaces between ring gear teeth, exactly 12 degrees. I then permanently stamped the wheel through the timing opening with: 12 degrees BTDC.

After complete assembly of the engine, timing the injection pump in accord with newly-placed timing marks and crossing injection lines over each other to cylinders number 4 and 5, I filled the engine with lubricating oil, connected the cooling system of the engine to a water tank, connected the injection pump to a tank of diesel fuel, connected batteries for the starter and gave the engine a try. By this time Mr. Graham was standing by, watching and waiting anxiously. The engine started almost immediately and purred like a kitten - on 8 cylinders! Mr. Graham smiled broadly! I was pleased that common sense with some ingenuity had prevailed over faulty and negative conclusions.

Unfortunately, the story of the Coast Enterprise did not end happily. Within a month or so after overhaul of the engine, the vessel accidentally struck a dead-head (a half-sunken log) in shallow water on its approach to Sointula from Alert Bay. The old wooden hull of the boat was so badly punctured that it foundered forthwith. Captain Graham got away unscathed, but the hull was so severely damaged and the newly-rebuilt engine contaminated with salt water to such extent that the vessel never returned to service.
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<u>The Bent Shaft (by Reuben Epp - 2002)</u>

In 1957 we were living in Port McNeill near the north end of Vancouver Island where I was employed as Donkey Doctor in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company. For those unfamiliar with West Coast logging terminology, a donkey doctor is a mechanic selected to respond to mechanical problems and repairs on logging machines and winches, commonly known as donkeys.

On mid-afternoon or a little later on a fine spring day in 1957, I was surprised to see the crew of our Washington Trackloader arrive in the yard in front of our camp mechanical shop well before normal quitting time. The Trackloader was a diesel-driven logging machine, mounted on tracks like those of a bulldozer, its general structure like that of a power shovel or back hoe, equipped with a steel boom over which a steel-rope cable ran to a grapple designed for picking up logs. I gathered that something had gone wrong to cause the crew to return to camp before the usual quitting time.

Wally, the operator of the Trackloader, accompanied by the logging foreman, came to me in the shop to explain what had happened and to discuss the course of action to follow. They explained that a loop of slack had accidentally been thrown in the steel-rope mainline to the grapple and that this loop had become caught between the gears of the machine at operating speed. The line had passed through between the gears and had therewith bent the countershaft that drove the main drum.

The foreman tensely explained to me the course of corrective action that he had formulated on his way back into camp after this accident. He would arrange to employ the crew on another machine while the Trackloader would be undergoing repairs. He then instructed us, Wally and me, to drive out to the machine that same evening to dismantle the machine as much as necessary to allow the bent shaft to be lifted out by another machine to be sent there in the morning. He guessed that it would take us until late evening to dismantle the machine as required. With that he left us.

Wally and I realized that this course of action would be costly in terms of machine downtime, shipping the shaft to Vancouver and back, removing, repairing and reinstalling it. After the foreman had left, Wally and I discussed the possibility of saving ourselves a lot of work by using the power that bent the shaft to straighten it again. We were tuned to the same wavelength. Wally and I were not inclined to undertake avoidable or unnecessary work.

We agreed to drive out to the machine right after supper to attempt to straighten the shaft or, failing that, to prepare it for removal from the machine. The machine had run most of the day and the weather was warm, consequently all of its parts would still be warm when we got there. This was an important consideration in planning to straighten the shaft because steel becomes progressively brittle as its temperature goes down. In the meantime I prepared an assortment of steel 'slugs' to be inserted between the gears. They were soft round steel rods, each about 2∏ inches in length, ranging in diameter from π inch to 5/8 inch. I put these slugs into my toolbox along with several sticks of white chalk for marking the gears.

All other tools that we might need were already in my service pickup. When we got to the machine after supper, we surveyed the damage and determined that the gears could still be turned by the engine. The bend in the countershaft was readily visible, especially when it rotated. It was a long gentle curve. The countershaft, as I remember, was between 4 and 5 inches in diameter with an overall length of 4 to 5 feet. The main drum shaft which it drove was not bent because it was supported in a solid steel drum. At one point in each revolution of the bent shaft the gears came together very tightly. Fortunately, the engine that drove the machine was a Cummins diesel equipped with a torque convertor. This allowed Wally to bring the engine up to power while maintaining control over rotation of the gears, or stopping them suddenly. The affected gears of the machine were of very sturdy steel construction; consequently they had suffered no damage in the accident that bent the shaft. We reasoned that they would then also withstand any forces needed to straighten the shaft.

The first step in our plan was to position the gears in their tightest position and carefully chalk-mark the gear of the bent shaft so we would know exactly where to insert the prepared metal slugs. Once we had made our marks on the countershaft gear and assured ourselves of the exact correct location by rotating the shaft several times, we positioned the gear of the bent shaft with the chalk-marked location just before it would be engaged by the gear on the drum shaft. In that position we placed a π inch steel slug between the teeth of gears in the location marked beforehand. Wally easily ran this slug through between the gears and immediately stopped their rotation. The slug had been flattened slightly but had made no perceptible change to the bend in the shaft. We picked the flattened slug out of the gear and prepared to insert a thicker one.

The second slug was of 3/8 inch diameter, which Wally ran through the gears at my signal. This time the machine growled and thumped audibly when the slug went through. This slug was crushed down between the teeth of the gear. We picked it out and rotated the shafts under engine power. The bend in the shaft had been visibly lessened but not yet fully straightened.

By this time we were confident that we were on the right track to straighten the shaft. So we repeated the procedure, each time inserting a slug of progressively greater diameter, and each time noting a distinct improvement In the bend in the shaft. The last slug that we placed was about 9/16 inch in diameter. To force it through between the gears, Wally revved the engine to fuller power. When the groaning engine forced the slug through, there was a loud thud, after which Wally immediately stopped the gears. We again picked out the mashed slug from between the gear teeth and set the shafts in motion. This time, not a tremor could be seen when rotating the shaft that had been bent.

Wally and I agreed that we had solved the problem of the bent shaft in a couple of hours and had saved our employer thousands of dollars in repair costs, not to mention the cost of lost production due to machine downtime that would have been incurred otherwise. To ensure that all was well, we replaced all the guards that we had removed and Wally put the machine through some of its usual paces. After confirming that the machine now handled logs as well as before the accident, we shut it down and headed back to camp.

When we drove into the yard at about 8:00 pm, the logging foreman was still there arranging operating plans for the following day. When he spied us returning early, he immediately came to our vehicle and demanded to know what in hell we were doing in camp when we had been sent to work on the Trackloader. I gently informed him that we had repaired the bent shaft and that the machine was ready for operation the next day. He was incredulous - and furious! He stepped around to Wally's side of the vehicle and demanded to know the truth. Wally smiled reassuringly and confirmed that the machine was indeed fixed and ready for work in the morning.

Thereupon, the foreman scrunched his heels in the gravel and strode away across the yard without further word. It seemed that our simple smart-ass solution to a mechanical problem, whose proportions he had overestimated, had nullified all working arrangements made for the crew for the days and weeks to follow. Neither Wally nor I heard any more about that job, but I was able to confirm later that the machine ran trouble-free for years thereafter. I don't think that Wally and I were popular with certain management personnel after that.
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<u>The Series-Parallel Switch (by Reuben Epp - 2002)</u>

When I was notified in 1951 to report to the maintenance shop of Pioneer Timber Company in Port McNeill near the north end of Vancouver Island for employment as a mechanic in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company, I was delighted. I needed just such a job to support our growing family at a time when automotive mechanics in the Fraser Valley where we then lived were paid starvation wages.

Upon arrival in Port McNeill I reported to the company personnel office where I was assigned to a bed in the bunkhouse and directed to report to Bill, the master mechanic (shop foreman) in the mechanical maintenance shop. I proceeded to the shop and found Bill to be an affable and knowledgeable person in his early sixties. After exchanging introductions, Bill asked me, "So you are our new logging mechanic?"

This question surprised me because I had never referred to myself as a logging mechanic. I told him that I was a mechanic, but that I could not honestly call myself a logging mechanic. He replied quite gently that the company employed only experienced logging mechanics and that the request I had received to present myself for duties must have been based on faulty information. He did not think that he could put me to work in view of my lack of logging maintenance experience. Bill informed me of this as kindly as he could and carried on by discussing their work and the maintenance problems they encountered.

He mentioned that they suffered from problems in electrical systems on various machines in their operation and no one there seemed able to deal with them effectively. Thereupon I informed him that I had much experience in solving problems in automotive and truck electrical systems and would be much surprised if I could not solve theirs.

When I had said that, he replied, "Do you realize how far you have your neck stuck?" I said, "Yes, I think so, but please give me a chance to prove myself by working for you for one week. I need the money to get back home and in the meantime I may be able to prove my worth to you. If you then cannot continue to employ me, I promise to be on the first available boat out of here. " Bill agreed.

He added that my first assignment to an electrical problem would be that same day on a Kenworth truck in which starter switch problems occurred several times per week. I was somewhat familiar with the electrical systems of diesel-driven trucks and knew that they were usually 12/24 volt series-parallel systems with circuitry that I had come to understand by examining and tracing circuit drawings in my Delco-Remy manual.

Later that afternoon I was confronted with the Kenworth truck with the starter switch problem. The switch was a manually operated one with built-in capability to switch from the 12 volt operating system over to 24 volts to power the electric starter. When I examined the switch I found it indeed burned to a crisp. Getting a replacement switch was no problem because these burnouts had happening for some time, therefore replacement parts were on hand. But the big question was, why did this continue to happen?

After removing the switch from the truck, I stepped into the office of the master mechanic to reorient my mental image of the switch circuitry with the help of his copy of the Delco-Remy manual that I had spotted there. Almost immediately the afternoon shift foreman came into the office and asked what I was doing. I replied that I was checking the D/R manual for the circuitry of the problem starter switch. He responded by saying that the problem with the starter switch lay under the hood of the truck and not in the Delco-Remy manual. With that remark he told me more about himself than I really cared to know. I put the manual back where I had found it and returned to the truck, confident that I had detected the cause of the switch-failure problem.

While removing the burned-out series-parallel starter switch, I had found an extra ground wire added to one of its terminals. My brief scan of the circuit drawing in the Delco Remy manual had confirmed that this terminal was indeed to be grounded, but through a circuit breaker that protected against burnout in case of circuit overload. My electrical test metre revealed that the subject circuit breaker on this truck was open, but I was unable to reset it. It seemed obvious that someone who did not know about this had added the extra ground wire to get the truck to start. But the added ground wire also bypassed burnout protection that a good circuit breaker would provide. The solution to the problem of switch burnout was becoming apparent.

When I went for a replacement starter switch from stores, I also got a new circuit breaker. I installed both in the truck but left off the added ground wire. As I climbed into the seat of the truck to try the starter, the shift foreman came by and spotted the ground wire lying there. He immediately called my attention to it and said that I had left off a ground wire without which the truck could not start. I said that since I was already seated behind the steering wheel, I would try the starter anyway.

Of course, since I had replaced the defective circuit breaker with a new one, the starter worked as it should and the engine started immediately. The shift foreman shook his head and said that although it seemed to be working now, the truck would surely be back again in the next few days with a burned out starter switch. I did not answer, having by then guessed who had added the ground wire that caused the burnout problem.

During the following week Bill assigned me to several other electrical jobs which I completed to his satisfaction, along with other jobs. The Kenworth truck in which I had replaced the burned-out starter switch had not returned. The day before the next Union Steamship boat to Vancouver was scheduled to arrive at Port McNeill, I mentioned to Bill that the boat would be in tomorrow. Without hesitation or further discussion, he answered, "What bloody boat?" He left me with a grin.
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[Air Brakes]

In the summer of 1954 I was employed as a mechanic in a logging camp at Port McNeill, owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company. Our master mechanic came to me one day to advise that the Kenworth gravel truck driven by Len was stuck on the road about 12 miles from camp with a brake problem. He explained that it seemed that the air brakes of the truck were stuck in the applied position and would not release.

He then asked me to get a replacement brake application valve from stores, take the shop pickup truck and proceed to the troubled gravel truck to replace the brake valve or do whatever was necessary to make the brakes work again. I gathered my tools and after a few minutes drove down the road, wondering what possibly could have gone wrong to cause the air brake system of the Kenworth to stick in the applied position. When I reached the troubled truck about half an hour later, Len was patiently waiting and glad to see me. He confirmed that the truck brakes were indeed on all the time, and that he could not get them to release or the truck to move. I asked him what had happened to bring about this condition. He replied that he had almost collided with a logging truck on the road and had been forced to jam on the brakes as hard as he could. He had narrowly but successfully avoided a collision, but had not been able to move the truck since. This gave me something to think about.

I examined the Kenworth and found that the push rods of the brake chambers at the wheels were well-extended, indicating that the brakes were indeed applied. I climbed into the cab and put my foot on the brake pedal and found that I could press it to the fully applied position with only the slightest pressure. The pedal was in fact not contacting the spring cage consisting of a hollow plunger that housed the pressure regulating coil spring that opened or closed the internal air valve to regulate air pressure applied to the air brake system. This plunger normally slid up and down in the body of the brake control valve when brakes were applied or released. Foot pressure on the brake pedal would push the plunger down against the spring within it to apply air to the system and releasing foot pressure would allow the spring to push the plunger back up again, thereby releasing air from the system.

In this case, air pressure was not being released. I pulled back the floor covering and examined the brake valve mounted in the floor of the cab. Upon lifting the foot pedal, I could see that the plunger beneath it was stuck at its lowest position in the body of the brake valve. I concluded that when Len had encountered the near-collision, he had probably jammed the foot pedal and the plunger down farther than at any other time during his operation of that truck. I guessed that during years of normal use a ridge of dirt might have accumulated at the end of the normal range of the plunger's movement, and that the unusually heavy brake application had forced the plunger onto or past that accumulation of dirt, causing it to stick there.

Whatever it was that was now holding the plunger down, I knew that the compressed spring beneath it was exerting maximum pressure to push it back up.

I did not care to undertake a brake valve replacement there on the road unless absolutely necessary. So, what was to be done? Perhaps the coil spring needed a little assistance from me to break loose the plunger so that the spring might pop it back up to its normal position. I selected a medium-

sized hammer to provide that assistance. After positioning myself, I smacked the brake valve sharply with the hammer on the side of the housing in which the plunger moved. As expected, the plunger popped up audibly and I could hear air being released from the brake system. A test with my foot on the brake pedal proved that the brakes could again be applied and released normally. The brakes were working. I had guessed correctly and the problem was resolved! Len was pleased!
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The Flooded Engine (By Reuben Epp - 2002)

In 1956 when we were living in Port McNeill near the north end of Vancouver Island, I was employed as Donkey Doctor in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company. For those unfamiliar with West Coast logging terminology, a donkey doctor is a mechanic selected to respond to mechanical problems and repairs on logging machines and winches, commonly known as donkeys.

In mid-afternoon on a nice summer day I received a call on the radio in my service vehicle from our dispatcher advising me to proceed to machine number 43 on Branch 17 to correct a problem. I asked the dispatcher what the problem was and he explained that the machine operator had reported that the engine had stalled on a heavy lift and now would not start again. I headed my vehicle toward Branch 17, knowing that it was almost ten miles away. However, that would also give me a little time to think about the problem while driving.

Machine number 43 was a log-loading machine driven by a Ford V8 gasoline engine of late 1940s vintage. I realized that since it was now mid-afternoon and the machine had been working since early morning, the engine would be at top running temperature. I also conjectured that if the engine stalled on an overload, the fuel mixture would have been be at its richest when the engine died. Consequently, the intake manifold and engine cylinders then be flooded with an overly-rich fuel/air mixture. Therefore, the engine would then not restart until the flooding condition was overcome. If the operator did not realize this and became impatient when it would not start, he might pull on the choke knob, thereby causing even greater flooding. Of course, the engine then would not start at all.

I surmised that after a period of trying, the operator might well have given up on starting the engine and would have telephoned the dispatcher for help. I also guessed that by the time I got there the flooded condition would have subsided somewhat and that it should not be difficult for me to start the engine by using proper procedure for venting the manifold and cylinders. The machine must have been standing idle for a half hour or more by the time I arrived on the scene to find the crew sitting around enjoying their smokes. After speaking to the operator I stepped up to the machine controls, made sure that the drive between engine and winch was disengaged, that the ignition switch was turned on, that the throttle was wide open, that the carburetor choke valve was wide open, and then pressed the start button.

The starter turned the engine over briskly for several seconds and then it burst into life. The problem was solved without doing anything other than venting the fuel mixture from the flooded engine. A show of magic could not have caused greater consternation among the crew. Then they went back to work on their various jobs. Later I explained to the operator in detail what had happened and what I had done to overcome it.
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Broken Axle - Colby Crane (By Reuben Epp - 2002)

In about 1967, during the time when I worked at the Columbia Cellulose pulp mill at Prince Rupert, the company had installed two new 70 ton Colby bridge cranes that ran on elevated tracks above the log unloading area at the mill. The cranes were capable of lifting carloads of logs and placing them in the wood-handling room of the mill or into the salt water of the west coast for storage until needed.

Part of my job at the mill was to investigate and report on major machine failures that caused production losses and to recommend corrective action, not only to make necessary repairs but also to circumvent similar future failures. I had been assigned to this position largely on recommendation of one of the plant engineers who was my boss and with whom I had been working for some time. He had developed confidence in my perceptions of mechanical problems.

The investigating and reporting procedure began with various department heads informing me in writing of machine failures, which I then proceeded to investigate. My report was to be in a format requiring a full description of the machine, the failure and its cause, providing understandable answers based on accepted mechanical engineering principles, including my suggestions to mill management concerning elimination or reduction of such failures.

One morning when I came to work, there was a report on my desk that one of the new Colby Cranes had broken an axle the night before and that the millwright crew was now up top removing the broken axle from the crane. My boss informed me to begin my investigation but to wait until the axle was brought into the shop before getting too deeply involved. He said that as soon as the axle came in, he wanted to see it too, suggesting that a new one would be ordered that day from the factory in the United States. This might require chartering an aircraft because the repair job was delaying production and could not await surface transportation.

I began my preliminary investigation and found that the two cranes had eight axles each, of which four were of one design and four of another. This made a total of sixteen axles for the two. I recognized instinctively that the failure of an axle on a machine in less than six months of service could forebode serious future mechanical problems involving the sixteen axles.

After the axle had been brought into the machine shop and placed on a low platform there, I began to examine it along with a number of engineers, including my boss. The break in the axle had occurred well in from its end at the base of a bearing shoulder for one of the axle bearings. The axle was probably about eight inches thick, as I remember it, and about eight feet in length. Examination of the break revealed that it had the earmarks of a fatigue failure. It had progressed from the surface of the shaft at the bearing shoulder to the centre of the shaft in the telltale pattern of fatigue failure. I also noticed that the base of the shoulder against which the axle bearing rested had been unnecessarily machined to a square corner, thereby introducing a stress point where fatigue failure would likely get its start.

The bearing that rested against the shoulder had nicely curved edges on both sides of outer and inner races. I determined that the base of the bearing shoulder could have been machined to a curve of about a half inch radius, which would not interfere with seating of the bearing on the shaft or against the shoulder. My observations were leading me to suggest a course of action. So I called my boss and asked him to come down to where the axle lay on the platform. I pointed out to him the square corner at the shoulder where fatigue failure had occurred and reminded him that if a new axle were ordered from the factory it would probably have a similarly design. This would lead to reinstallation of an axle whose design had proven to be defective by this failure. Furthermore, flying in an axle from the United States would be a very expensive undertaking, which we might be repeating on fifteen other axles in the next several years, not to mention the probability of repeat failures. After all, this axle had lasted little more than half a year before it failed.

My suggestion was that since we had the required steel shafting on hand at the mill, we put our machinists to work immediately to machine a replacement axle with the suggested half inch radius at the bearing shoulder. That would eliminate the stress point which caused this axle to fail. The axle could be machined in our shop in about the same time it would take to obtain a new one from the factory and would avoid the cost of a charter flight to and from the United States. I further suggested that as soon as this be done, we assign the machinists to make similar replacement axles for installation when other axles failed in the future as expected..

I further predicted that since the first axle had broken in just over half a year, we might expect all sixteen axles on the two machines to break in about two years, if they were of the same faulty design. If we could avoid such breakage by eliminating the stress point in the axles that our shop people would machine, we could probably avoid or greatly reduce such breakage thereafter.

My boss was convinced that I had the correct solution to the problem and took it to management of the mill. The mill manager agreed, so the machinists were immediately put to work on the replacement axle. The job went as planned and the axle was duly installed in reasonable time.

I was not at the pulp mill when the two years had transpired. I had to leave for other work before then because arthritis forced me to seek a job that was physically less demanding. But, my boss visited me at my new job at about the end of those two years and was delighted to inform me that in that time fourteen of the sixteen axles had broken and had been replaced, but never had they needed to replace one of those made in the shop at the mill. He made my day!
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Buckled Hydraulic Cylinder (by Reuben Epp - 2002)

From 1959 until 1964 I was employed as assistant master mechanic for the logging division of Columbia Cellulose Company in Terrace, BC. The company's log-loading operation at the railroad tracks near the Kalum river employed a Wagner Lumberjack to unload logging trucks and to place these logs on railroad flatcars to be hauled to the pulp mill near Prince Rupert. The Lumberjack was like an oversized forklift on large rubber-tired wheels and with a front-end grapple that consisted of two flat steel horizontal forks with two long overhead curved steel tines that would clamp down upon and around a grapple-full of logs. I don't remember the load-carrying capacity of the Lumberjack other than that it could grasp a truckload of logs at its centre, lift it and carry it to a flatcar and place it between the stakes on the deck of the car. The hydraulic cylinders that operated the tines were long and slender.

During fall months when days were short and the machine worked in the dark for a goodly portion of each shift we occasionally incurred the total buckling of a grapple cylinder. The buckled cylinder when brought into the shop usually had a severely bent piston rod and the cylinder barrel burst open at the rod end. The cylinder was in fact totally destroyed, requiring replacement. A new cylinder was expensive, and the machine would be out of production while a replacement was obtained.

As assistant master mechanic it was my responsibility to find out what caused such failure of a machine component and if possible discover how to prevent recurrence of such failure. When I asked the operator of the machine what had happened, he explained that while operating in the dark he could not see the ends of the logs. The headlamps of the machine were aimed in a forward direction and since he was carrying logs that were often as long as a railroad flatcar, the ends of the logs were out of his sight in the dark. The area in which he worked was not illuminated.

If the end of the load or one of the logs came into contact with an object such as a tree stump while the machine was moving forward or backward, tremendous leverage was exerted against one of the grapple tines, attempting to force it to open. Since the machine was large and powerful, the operator would not immediately notice that the load was in contact with an obstruction, with the result that the grapple tine would be forced to open despite the fact that the hydraulic cylinder held it firmly closed. Further movement of the machine would cause the leverage applied by the log to the grapple tine to increase until it overpowered the strength of the cylinder, causing it to buckle, thus bending the piston rod and splitting the cylinder.

So then we knew what was causing buckling of the grapple cylinders. The question was: What could be done to avoid it? After several more instances of buckled cylinders, it became imperative that corrective measures be taken soon. At about that time the factory representative of the Wagner manufacturers of the Lumberjack, arrived at our shop. I immediately approached him about an idea that I had been contemplating as a possible solution to the cylinder problem. I asked him whether his company could supply a pressure relief valve to install on the hydraulic cylinders in question, that would allow a cylinder to let the tine open when pressure in the cylinder approached a certain limit. I realized that this would allow the load to open the grapple, but reasoned that it would prevent buckling of the cylinder. The load could be picked up again but a buckled cylinder could not be restored.

The Wagner representative said that he would discuss this possibility with engineers at the factory, after which he would let me know. I requested that he do so soon because of the seriousness of the problem. He telephoned me from Vancouver several days later and informed that their factory engineers had advised that it was not practically possible to consider installation of such a relief valve. He went on to advise me why this was impossible, but my hearing was by then going bad. We did not talk for long. I went to the planning board.

I reasoned that if a simple hydraulic relief valve were installed at the closed end of each cylinder, set at about 500 pounds of pressure higher than the maximum operating pressure of the system, the valve would release oil from the closed end of the cylinder before it could be forced to buckle. The oil thus released would simply be returned to the oil tank of the system.

I discussed this possibility with my supervisor who agreed that we try it. It would cost less to try this than to buy one new cylinder. In short order I obtained two suitable relief valves and scheduled our mechanics to install them on a weekend as planned. After they were installed we never again experienced a buckled hydraulic cylinder in the grapple of that machine.

On the next visit of the Wagner representative some months later, he asked to be taken to the Lumberjack so he could see it at work. I drove him there myself without a word about the relief valves. When he saw the machine working, he asked me what were those funny-looking valves sticking out of the ends of the hydraulic cylinders, I informed him that they were the relief valves that their factory engineers had determined to be 'not practically possible.' When he asked me whether they worked, I told him that we had never again bought another grapple cylinder after the valves were installed..
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Japanese Drill Bits (by Reuben Epp - 2002)

It was about 1980 and I was Director of Vocational Training at Northern Lights College in Dawson Creek. My prime responsibilities consisted of supervising training in the mechanical, carpentry and welding trades in the college there. My experience and abilities as an all-around mechanic and general practitioner in hands-on trades suited me well for those duties. I had the trades knowledge that helped me to relate to our instructional personnel in the various trades.

On a day in 1980, as aforementioned, our Autobody Repair shop instructor Hank stormed into my office to inform me indignantly that "These damn Japanese drill bits are no good. Just look at the damn things." With that he handed me several drill bits whose cutting tips were burned very blue. I examined them and concluded that they were in fact not useable. When I asked him how long he had been troubled with this problem, he replied that it was probably as long as we had been buying Japanese drill bits.

I knew that our purchasing division had been buying drill bits from Japan for quite some time, yet I had received no complaints about them from other instructors. Therefore, I asked Hank to show me how this drill bit problem occurred. He invited me to his shop for a demonstration.

When we arrived there, he set up the drill press to drill a hole in a flat steel bar with a new drill bit. I stood by, watching carefully. When he began drilling through the steel bar, the result was little progress and much smoke. Since I have a keen perception of direction of rotation of mechanical devices, I saw that the drill bit was turning backwards. When I pointed this out to Hank, he was taken aback.
Knowing that electrically-operated machines in the vocational division of the college were mostly on three-phase power, I asked Hank whether any electrical work had recently been done in his shop. He told me that there had been repairs to the electrical portion of the heating system. I then suspected I knew the cause of the drill bit problem because I was somewhat familiar with three-phase power.

A three-phase electrical circuit has three power wires, beside the ground wire, connected to the motor being energized. Designating which of the three wires goes to which terminal is no big deal. The three power wires are simply connected to three terminals on the three-phase motor, after which the circuit is tested. If a motor then turns backwards, two of the three connecting leads are simply interchanged, after which the motor turns in the opposite direction when switched on. It appeared that during recent electrical repairs in the Autobody shop, repair personnel had altered the connection sequence of the power cable to the drill press and had not tested for direction of rotation after disconnecting and reconnecting electrical lines. It was a simple matter to shut off the power at the distribution panel and then to interchange connections of two of the three wires in the cable to the drill press. After that, the drill press turned in the correct direction.

A subsequent drilling test prompted Hank to allow that Japanese drill bits were perhaps not so bad after all!
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Japanese Drill Bits [Short version] (by Reuben Epp)

I was director of vocational training in the College at Dawson Creek when one of my shop instructors came to my office brandishing several drill bits, complaining "These damn Japanese drill bits are no damn good." He held them under my nose for me to get a good look at them. They were by then in fact "no damn good" because their tips were burned deep blue in colour.

I suggested that this matter needed some investigation and that I would come to his shop with him to see what was going on.

Once there, I suggested that he get a new drill bit of the same kind and demonstrate to me what was happening to these Japanese drill bits. He did as suggested and began drilling on a piece of ordinary steel. The bit immediately began to smoke. But my sense of direction told me that the bit was turning backwards, which it surely was. So we quickly reversed the turning direction of the drill press, whereupon another new Japanese drill bit drilled the steel very nicely. What had happened was that some less-than-smart electrician had reversed the connections of the three-phase electrical circuit, which caused the machine to reverse direction of rotation. Had the dope tested the press before leaving it, he would have avoided this obvious faux pas and we would not have realized how dumb he really was.

Problem solved!
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Farrier Training Exhaust System (by Reuben Epp - 2002)

It was early in the 1970s and I was Vice Principal of the B.C. Vocational School in Dawson Creek. My prime responsibilities then consisted of supervising training in the mechanical, carpentry and welding trades in the provincial vocational school there.

At about that time we received approval from the Ministry of Education to develop a Farrier Training program at the school. (A farrier is one who shoes horses). We had room for the program in a shop connected to our Agriculture building. After doing some research by telephoning other schools with such programs, we decided that a good shop layout for such training would be to install sixteen hand-operated forges and farrier's anvils for the students and another forge and anvil for the instructor. The student forges would be placed in clusters of four, around four steel tables, with smoke vents from each of four forges at each table leading into a central smoke stack from that table. This determined that there would be four tables, each with four forges, arranged in a line near one wall of the shop.

I designed the layout of the tables and then the entire exhaust system to gather the emissions from seventeen forges to bring them all together via a sheet metal exhaust manifold to an exhaust blower mounted in a window opening high in the wall of the building. I carefully designed each part of the manifold to ensure that the diameter of each section would accommodate the exhaust from various legs of the manifold leading into it. This determined that the six inch vent stacks from sixteen forges eventually converged into one final section of the manifold with a diameter of about sixteen inches, which nicely fitted the inlet of the intended blower.

We already possessed two identical surplus blowers, left over from the days when the vocational school buildings and campus at Dawson Creek had been part of the mid-Canada defence line. I was confident that one of these blowers would nicely take care of the smoke from the seventeen forges. All that we needed to add was an electric motor.

In those days provincial government buildings in B.C. were owned and maintained by the Department of Public Works. Construction such as we were planning had to be submitted to that Department which would take complete charge of design and construction. So, when we were ready and all approvals had been obtained, we invited Public Works to send an engineer for consultation in connection with construction of our intended farrier training exhaust system. We expected that the engineer would not likely be familiar with such a system because there was none other in B.C. at that time.

Consequently, I hoped that my detailed, although unprofessional, drawing would expedite official planning for the project.

When the engineer arrived, he turned out to be one of those haughty types with a high opinion of himself and his qualifications, but who only condescendingly consulted with us on technical engineering matters involved in the design of the project. I presented him with a copy of the plans that I had drawn up and showed him the blower that we intended to use in it. He seemed not at all happy. He immediately informed me that the capacity of the blower was insufficient for this project. Whereupon I informed him that we had two identical blowers that could easily be installed in parallel to double capacity. He also informed me that my specifications for pipe diameters at various stages of the manifold were faulty and were inadequate to meet requirements. However, he would take care of a redesign, using my recorded measurements of the overall layout as noted in my drawing. I was indeed impressed!

Some time later we received notification from the Department of Public Works that their plan for our installation was now approved and they would be calling for tenders on the construction project. Our notification included a blueprint of the exhaust system as they specified it to be built.

I examined the blueprint, wondering what changes a professional engineer might have made to the various specifications I had suggested. It turned out that the haughty engineer had copied my specifications exactly as I had presented them, but had redrawn them in the professional format required by his department. He had signed and dated the plans as his own. And thus they had been approved.

I decided not to make an issue of this blatant plagiarism but would await the performance of the construction I had designed. When the system was completed, it indeed performed well. I enjoyed the feeling that comes with a job well done and was happy with it. I dismissed thoughts of the professional engineer who had copied me to his personal credit. But I valued and noted the lesson he had taught me about ethics in supposedly professional circles.
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Blown Cylinder Head Gasket on Forklift (By Reuben Epp - 2002)

It was about 1967, during the time when I worked at the Columbia Cellulose pulp mill at Prince Rupert as maintenance inspector, when I visited the company's maintenance shop for trucks and mobile equipment during my inspection rounds and noticed that one of the forklifts from the production floor of the mill was in the shop for repairs. When I arrived, the hood had been removed from the engine of the forklift and the cylinder head had been removed.

This forklift was a rather small machine employed in the handling of rolls of sheet pulp. It had a four cylinder Continental engine, frequently found in small industrial machine applications. Upon questioning why the machine was in the shop with the cylinder head removed, the maintenance shop foreman informed me that the forklift had come in with a blown cylinder head gasket which they were about to replace. His attitude toward my question was friendly because he realized that asking questions was simply part of the job to which I had been assigned. I did not press him further and continued with my inspection rounds in other areas. But, in the back of my mind I knew that a cylinder head gasket does not blow without cause. I wondered what the foreman was doing about determining the cause in this case.

Several days later when I again visited the shop, the same forklift was back again with the engine hood and cylinder head removed. When I asked the maintenance foreman about it this time, he replied that they had not detected at the time of the first head gasket replacement that the cylinder head of the engine was warped. So, he was now sending the cylinder head to a machine shop where it would be planed to perfect straightness. This answer seemed plausible to me, so I continued with my rounds of inspection.

Several days or a week later, when I visited the maintenance shop, I again came upon the same forklift being treated for the same head gasket problem. I was by then most curious as to the cause of this repeated failure. The maintenance foreman assured me that this time they would correct the problem by installing a new cylinder head. Although I was doubtful of the corrective measures being undertaken, I could not intervene without alienating the mechanical maintenance foreman and his crew. Furthermore, perhaps they were on the right track. So, I carried on with my rounds.

After another half week or so, when I again visited the shop, the same forklift was back in the shop with the cylinder head gasket blown again. The engine hood and the cylinder head were removed. This time I determined to be more aggressive in addressing the problem because I detected that the shop crew had by then begun to realize that they were approaching an impasse in their response to the problem, and therefore might be receptive to outside suggestions. So I asked the maintenance foreman whether they had checked the top surface of the engine block with a straightedge to determine that it was straight. He surprised me by answering that they did not have a straightedge. I suggested that I would obtain one and would come back to him, and together we could check for straightness of the engine block. He agreed.

Knowing that the blades in lumber thickness planers are perfectly straight, I went to company stores and borrowed one blade for a sixteen inch planer. I then returned to the shop and the problem forklift, where the maintenance foreman awaited me.

After the top surface of the engine block was scraped and thoroughly cleaned, we placed the planer blade on edge upon the top surface of the block. It quickly became apparent that the surface was not straight. The engine block appeared to be warped. That explained rather conclusively why the cylinder head gasket had blown repeatedly. This condition dictated that the engine would need to be removed for reconditioning or replacement. Since pulp production in the mill could not await a reconditioning job, and a spare engine was on hand, the engine was replaced. That ended the problem of blown head gaskets.

I was not able to determine why or how the engine had become warped because the crew that ran it was not about to divulge the possibly that it had been overheated during their operation of it.
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Corrosion Damage to Hoist Cylinder
(by Reuben Epp – 2002 - 12/11/02)

It was about 1972 when I was Vice Principal of the B.C. Vocational School in Dawson Creek. My prime responsibilities in that position consisted of supervising training in the mechanical, carpentry and welding trades in the provincial vocational school there.

One day our Instructor of Automotive Mechanics telephoned me to inform that one cylinder of the twin-post hoist in his Automotive Mechanics section of the school had just come down, leaving the front end of an automobile high on the front end cylinder of the hoist and the rear end of the vehicle down on the floor. He had thereupon immediately lowered the front hoist cylinder with the automobile to the floor without damage or injury to anyone. The twin-post hoist in question had two large vertical hydraulic cylinders, one at each end of the hoist. The cylinder at the front end of the hoist was movable on rails in a long covered pit in the concrete shop floor. This cylinder could be moved back and forth to accommodate vehicles of varying length so that the lift cylinder could always be placed directly beneath the front axle of a vehicle to be hoisted. The cylinder at the rear end of the hoist was stationary, permanently buried in the ground and bolted to the concrete floor of the shop.

When we examined the hoist, it appeared that the oil in the stationary hydraulic cylinder that had come down must have escaped from the cylinder for reasons then unknown. We found no visible signs of oil leakage. Yet, a test of the cylinder revealed that oil was definitely leaking from the cylinder because it would not stay up when lifted and with the control valve closed. So, we concluded that a leak had developed in the cylinder buried in the earth under the shop floor and that the oil was leaking into the ground surrounding it.

I called in the Foreman of the local Department of Public Works, who at that time were responsible for all maintenance at our Provincial Vocational School. After explaining to him what had happened and what we had determined, he agreed that our findings indeed indicated a leak in the hoist cylinder. So, he put a crew to work to break up the concrete floor around the hoist cylinder and to dig it out manually. When we got the cylinder out and had washed it down, we discovered a hole about the diameter of a lead pencil had been corroded through the 3/8 inch steel barrel of the cylinder. That explained why the hoist had come down.

Since Public Works had no welding facility, I suggested that we would take the cylinder to our Welding Training shop and cut away the corroded steel barrel of the hoist cylinder. Then we would obtain a new steel pipe of identical dimensions and weld it in place to restore the cylinder to its original condition. This suggestion was accepted by all those concerned with this problem.

However, I had by then learned that the hoist cylinder had been in the ground no more than six years. I also knew that our campus was built on a former swampy area in Dawson Creek in which the soil would be strongly acidic. This explained why the steel outer barrel of the cylinder had corroded so rapidly as to puncture its 3/8 inch steel wall in only six years. This soil condition had apparently not been taken into account when the hoist cylinder was installed six years earlier. They had at that time simply buried the cylinder in the earth beneath the shop floor. I resolved not to let that happen again.

So, I met with the Foreman of Public Works during which meeting I informed him that while the hoist cylinder was being repaired in our welding shop I would design a concrete caisson to be poured in the ground below our shop floor into which the repaired hoist cylinder could be installed. The caisson would isolate the cylinder from the surrounding acidic earth, thereby preventing corrosion from chemical reaction with the surrounding acidity. He agreed that the idea seemed sound and that his department would construct the caisson and reinstall the cylinder as recommended.

So it came about that the hoist in the automotive section of our school was repaired and reinstalled in a simple and common-sense manner. When I retired from that institution thirteen years later, that hoist was still working fine. I would be surprised if it failed for reasons of corrosion in the years since then.
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Left Hand Thread in Wheel Nuts (by Reuben Epp - 2002)

It was in summertime about forty years ago, and we were driving Number 1 Trans-Canada Highway somewhere between Sicamous and Revelstoke, when we were flagged down by a motorist whose car stood on the side of the road. He waved to us with a wheel wrench and pointed to his car on which one axle on the side facing the road was jacked up. I assumed that he needed help, probably with a flat tire, so I stopped our car off the road near his.

He approached me and asked whether I was carrying a wheel wrench in my car. I affirmed that I had one and that it was exactly the same kind as his. By then I noticed that his wrench was twisted badly out of shape. It was in fact no longer useable. When he asked whether he could borrow my wrench to take off the wheel with the flat tire on his car, I was concerned that he might reduce my wheel wrench to the same condition as his. However, I assented to let him use it, but went with him to see what was happening in his use of the wheel wrench.

When we approached the flat tire on the left-hand side of his car, I recognized the manufacturer's markings on the wheel nuts and wheel studs indicating that they were of left-hand thread. In those days some car manufacturers used left-hand thread on the left side of their vehicles, presumably to counteract possible loosening of the wheels on the left-hand side during operation. Whatever the original reasoning might have been, this automobile had left-hand thread on the studs of the wheel with the flat tire on the left-hand side of the car. No mistake about that!

I watched as the owner bent down and attempted to undo a wheel nut with my wrench by turning it to the left as one would normally do - in the case of wheel nuts with right-hand thread. He was at the point of twisting my wheel wrench into the deformed shape of his own when I asked him to hold off for a moment.

I then carefully explained to him that the letter L, clearly visible where it was stamped into the exposed end of each stud of that wheel, indicated that the stud had left-hand thread. I also explained that the notches cut into the six corners of the hexagon wheel nut also indicated left-hand thread. Then I pointed out that by observing the slant of the threads on the exposed portion of the wheel stud, it could be seen that the threads wound around the stud at an angle opposite to that of threads on a right-hand thread. Therefore these nuts had to be turned in the direction opposite to the accustomed one when loosening or tightening.

I suggested that if he turned the wheel nuts to the right on the wheel with the flat tire, that they would loosen. But, if he continued forcing them to the left, he would either twist off the wheel studs or twist my wrench as he had already twisted his own. I informed him that I was a mechanic and suggested that I would be pleased to show him.

The fellow was upset by my suggestions and made it clear that he knew in which direction to turn wheel nuts and that he was by no means accepting suggestions to the contrary. He reacted further by handing me my wheel wrench without further word, gesturing that our conversation had ended. Upon getting this reaction, I also knew that there would be no more discussion nor help possible. The weather was warm and the highway provided ample opportunity to flag down other possible assistance, so we left the scene of the flat tire knowing that we were not carelessly abandoning anyone to exposure to the elements in inclement circumstances.

Since then, I have occasionally wondered about what thoughts came to the mind of that driver when he discovered after we left, as physical facts determined that he inevitably would, that the wheel nuts on the left-hand side of his car had left-hand thread that had to be turned the other way.
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The Broken Crankshaft (by Reuben Epp - 2002)

The year was about 1955 when we were living in Port McNeill near the north end of Vancouver Island where I was employed as a mechanic in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company. It was winter and coastal rainfall had been heavy of late. The Master Mechanic of our maintenance shop had left to spend Christmas with family in Vancouver. The camp superintendent had assigned Harvey, one of my co-workers, to fill in as Master Mechanic during that period. Logging production had virtually come to a standstill for Christmas and winter.

However, our shop crew remained on duty repairing and preparing various machines for work when logging would again resume. One day Harvey came to me with the news that one of our Kenworth trucks had a broken crankshaft, and asked me to begin preparing to lift the Cummins Diesel engine out of the truck for the necessary repairs. I was surprised to hear of a broken crankshaft in a Cummins diesel engine, and asked Harvey how this had happened. He replied that he didn't exactly know, but he had discovered it that morning when he went to start the engine to move the truck. He said the crankshaft was jammed solid and the electric starter would not budge it.

I went to the truck where it was backed into one of our auxiliary shops with the cab and engine hood of the truck protruding from the large doorway. On this vehicle the engine exhaust system was entirely above the level of the top of the engine. The top end of the exhaust pipe had a hinged cap intended to close the exhaust pipe whenever the engine was shut down. I noticed that the cap was now standing open and that the exhaust pipe appeared to be directly beneath the edge of the shop roof under which the truck was parked. I wondered whether there was any connection between the open cap of the exhaust pipe under the edge of the roof and symptoms of a 'broken crankshaft' that Harvey had detected.

I went to my toolbox and got a large socket and a long-handled ratchet to fit and turn a nut on the end of a shaft that protruded from the front of the Cummins diesel engine with a drive pulley on it. I placed the socket on the nut and pulled on the ratchet handle. The engine would not move and appeared to be solidly blocked internally. On the other hand, I could turn the engine backwards quite easily after exposing the flywheel. I suspected that a column of water had collected in one of the engine's cylinders during a recent rainstorm, when rainwater from the edge of the roof had probably dribbled into the open exhaust pipe of the engine and through an open valve into one of the cylinders. The accumulated water in the cylinder would then stop the piston from making a complete stroke.

Since the Cummins diesel engine had a compression release system to facilitate starting, I climbed into the cab and pulled open the compression release and locked it there. I then went back to work on the pulley shaft with my socket and ratchet. I rotated the engine until it came into contact with the blockage and then continued to apply pressure to force the water out of the cylinder through the opened compression release valve until I could turn the engine through a full rotation.

After several such rotations I climbed back into the cab of the truck. While leaving the compression release in the locked open position, I tried the electric starter. The starter spun the engine freely and effortlessly. With the engine till spinning, I unlocked the compression release and the engine started with a blast of smoke and water spray from the exhaust pipe. The problem of the broken crankshaft was solved - and rather inexpensively!
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Synchronizing the Chimes on a Clock

We have one of those lovely antique, hand-wound, eight-day brass pendulum wall clocks that were popular in business offices and homes 75 and more years ago. It is one of those with three hands: a minute hand, an hour hand and a day hand that shows the day (up to 31) of the month.

Of late, after almost 100 years of service in our family, our clock began showing need of repairs. I was fortunate to find a local clock repairman familiar with the clock and willing to undertake its repair.

Several weeks later, he telephoned me that the clock was ready and the repairs guaranteed. So I brought the clock home and hung it in its usual place on the wall of the living room.

It soon became obvious that the mechanism was not synchronized correctly to accommodate 24 strokes of the chimes in two 12 hour time periods each day and one shift of the day hand in each 24 hour period. The clock could be set to strike the chime correctly as indicated by the hands on the face, but would then move the day hand at the wrong time, or vice versa. It was out of synch by six hours: striking 12 strokes at midnight and noon as it should, but changing dates at 6:00 pm in the afternoon. This, of course, could not be tolerated. I was confident that the necessary adjustment could probably be made easily.

Being a mechanic by experience and nature, the first thing I did was to think about the implications of the problem. This is where the work of a mechanic begins! I remembered that a manual movement of the minute hand, forward and backward across the 6 o'clock position on the face, increased the number of chime strokes of the hour heard each time the minute hand crossed the number 6 position in the forward direction. Then I thought about it some more.

What if I did this 12 times? Would that compensate for the 6 hour difference in synchronizing my clock?

I began at the 6 o'clock position, immediately after the day hand had shifted to the next day. The first two moves of the minute hand indicated that I was on the right track. After 10 more such moves the clock mechanism performed as prescribed.

Today, the next day, all seems fine. Great clock! Try it again after another 100 years!
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<u>Case Steamer Axle 06/04</u>

My father told me about their move from Nebraska to Saskatchewan in the spring of 1902. They had started from their home farm near Lushton, south-east of Henderson with a Case steam tractor pulling a caravan of wagons and hay-racks loaded with their personal and household belongings. They were heading for York, Nebraska, where they were to board a freight train for the trip to Saskatoon and points north several days later.
However, somewhere between Lushton and York, the front axle of the Case steamer broke in the middle, bringing their caravan to a halt. What to do? The answer was far from obvious. A new axle was not to be found, and their schedule could not wait for a factory order. However, there in Nebraska, grandfather found a country blacksmith who was also great at forge welding.

To make a long story short -- the blacksmith took the broken axle and properly supported it above his forge, with the broken ends almost touching. He then built his fire around the break and heated the steel to incandescence. At just the right moment, he signalled several husky men to ram the two ends of the axle together. There was a shower of sparks from the molten steel at the break, but the axle had again become one piece.

That axle finished the trip to Saskatchewan, and then some. he tractor with the mended axle successfully pulled breaker plows to break their several quarters of prairie land for their first crop in Saskatchewan.
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The Frozen Airline (by Reuben Epp - 2002)

It was during the winter of 1955-56, while we were living in Port McNeill near the north end of Vancouver Island, where I was employed as a mechanic in a logging camp owned and operated by Pioneer Timber Company, a branch of Alaska Pine Company, when I was approached by our Master Mechanic with a special request. Although he at first hesitated to ask, he requested that I dig down to the airline that crossed underneath the gravel road uphill from our shop. The airline ran downhill from the air compressor in the power plant, crossing horizontally underneath a gravel road and from there to our shop. The cold weather of that winter had solidly frozen the road with the airline buried in it. Some condensed water in that part of the line was also frozen, cutting off our supply of compressed air to the main mechanical maintenance shop.

Something had to be done immediately because some functions in the shop could not be carried out without compressed air. Camp labourers had been laid off for the winter, leaving us in the shop to our own devices to take care of such problems. The solution that our Master Mechanic saw was for us to dig down to the pipeline with a pickaxe and to thaw it out. That was not easy to do when the hard-packed gravel roadbed was frozen solid with the pipeline buried in it to a depth of a foot or more.

Nonetheless, I proceeded to do as requested because I had respect for the Master Mechanic and he readily acknowledged that I was really not hired as a ditch-digger but as a mechanic. I went to the tool shed, got a pickaxe and prepared to attack the dig. Before doing so, I opened the airline valve in the shop and listened at its open end. I could hear a whisper of air coming through from the compressor. I left the valve open and proceeded uphill to the air compressor, tracing the pipeline from there down toward the trouble spot under the frozen road. I found a union in the pipeline not far downhill from the compressor.

A plan of action came to mind. I returned to the shop and got my pipe wrenches and a quart can which I partially filled with methyl hydrate from a barrel in the fuel shed. I then went to the compressor and shut off the air valve, opened the union in the pipe and poured in the methyl hydrate. Then I reconnected the pipeline, opened the valve at the compressor and returned to my assigned task of digging the frozen gravel roadbed.. I did not dig long. I think it was about ten minutes later when I heard a loud shout in the shop, "Shut that damn thing off!" I smiled inwardly and continued to dig obediently. Then my co-worker Shorty came out of the shop door and called to me, "Hey, you can quit digging and come back to the shop. The airline is OK now." I had by then hardly made a mark on the road.

I shouldered pickaxe and tools and returned to the shop, pretending surprise at being relieved of the digging job. When I asked what had happened, Shorty explained, "The airline suddenly let fly a blast that stank like a brewery." I put the tools away and returned to repairing logging equipment, satisfied that laziness, with maybe a little cunning, had once more paid off.

The Master Mechanic came by not long thereafter with a knowing smirk on his face but without any further comment!
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Removing the Steering Wheel (By Reuben Epp - 2005)

It was about 1954 WHEN I was employed as a logging mechanic in a repair shop run by Pioneer Timber Company at Port McNeill, British Columbia. I was on the evening shift when logging trucks that needed repairs were brought into the shop where I worked.
One particular evening, our evening shift foreman Ed and my working buddy Tag, informed me that they would undertake a repair job on a certain Kenworth truck that was already in the shop. I was assigned to work on another job in the same shop. I don’t remember details of their entire job, except that it was on the steering system, which meant that the steering wheel had to be removed.

Before long the two had removed the horn button and cleared away everything obstructing access to the centre of the steering wheel. As with most truck steering mechanisms in those days, the shaft from the steering wheel to the gear-box deep under the hood was of tubular steel, with a tapered spline at its top end that fitted into the steering wheel, threaded above that for a nut to hold the wheel securely on the shaft. To get the steering wheel off so that work could be done on the steering gear, the wheel had to be pulled from the tapered end of the shaft. This was easy enough to do with a steering wheel puller, which this camp shop did not have.

The foreman and Tag busied themselves with crowbars, two-by-fours and other paraphernalia, attempting to push the wheel in the upward direction, which was made difficult by a large flange just below the spokes of the wheel. After I had heard their grunting, groaning and pounding for the better part of half an hour, I walked over and asked whether I might help. In the past, I had removed dozens of steering wheels without a puller, but it did not seem appropriate to tell them that just then. After another half hour of unfruitful groaning, they told me they were going to the blacksmith shop to make a steering wheel puller. I knew that they were well capable of building a wheel puller, but I also knew that by the time they had it made, it would be too late to finish the steering job before the end of the shift at midnight. This would mean either tying up the truck the next day or working several hours of overtime to complete the job after midnight.

After taking the necessary measurements, they headed for the blacksmith shop, indicating that I could try my tricks during their absence. When all became quiet in the truck shop, I could see that they were busy at the forge in the blacksmith shop. I went to my toolbox, picked up my favorite bronze drift (about the size and shape of a size D flashlight battery, but a little longer) a two-pound ball peen hammer, and climbed into the driver’s seat of the Kenworth. I made myself as comfortable as I could in the awkward position required to exert upward thrust of my knees against the underside of the steering wheel at the angle of the shaft. While thus positioning myself, I noticed that the steering wheel and its shaft could be moved up and down ever so slightly, which was exactly what I had expected and needed. I turned the steering wheel nut until it was exactly flush with the top of the shaft. In that position, the nut would prevent a hammer stroke on the end of the shaft from damaging the threaded portion of the shaft. The softness of the metal in the bronze drift would avoid distorting the end of the shaft that would almost surely occur if it were struck directly with the hardened face of the hammer.

Then came the crucial moment. I placed the bronze drift squarely on the top of the shaft and nut, holding it firmly with my left hand. With the ball peen hammer in my right hand, I placed the flat surface of the hammerhead on top of the bronze drift and tested by tapping lightly. All seemed OK! I then scrunched my knees against the underside of the steering wheel, and while exerting as much pressure as I could, upward and toward the driver’s seat, I smacked the top of the drift sharply with the hammer. When I noticed the steering wheel bounce, I grabbed its rim to check if it was free. It wobbled loosely on the steering shaft. And the steering wheel nut could still be turned on and off easily. Success! That part of the job was done. But, now what to do about it? Reluctantly, I went to my colleagues and told them that I had accidentally found a way to pull the steering wheel. They were understandably flabbergasted but said nary a word to me about it after returning to their steering repair job. They completed their job successfully before midnight.
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