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From Truck to Well Puller

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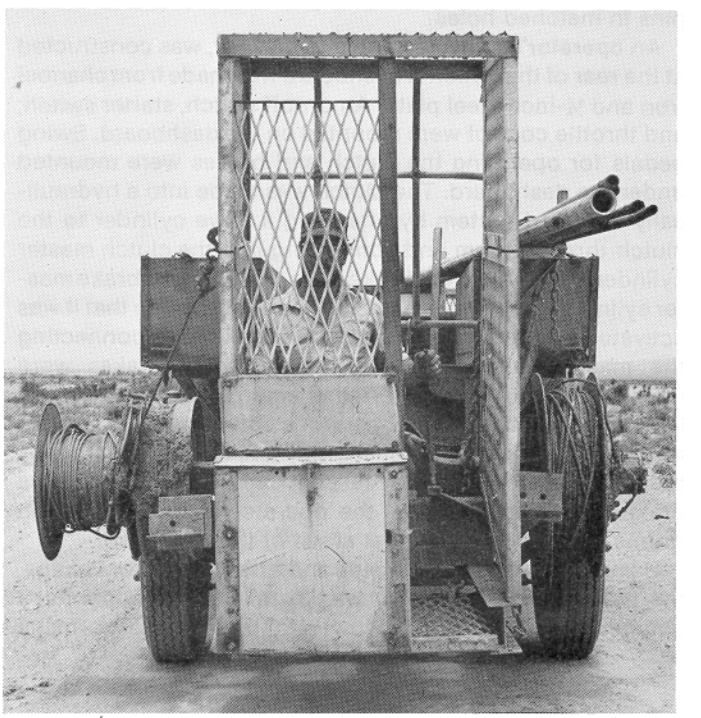
In south-central New Mexico, as in many arid areas, water wells are the main source of water for livestock. On the Jornada Experimental Range, a 190,000-acre range and livestock research facility located north of Las Cruces, N. Mex., a major maintenance problem is the replacement of pump leathers and cylinders of the 14 water wells that are 300 to 400 feet deep. In former years the wells were repaired by using sheave assemblies and a cable attached to a vehicle that provided lifting power when driven away from the well. Although effective, this method was neither efficient nor safe. Jornada personnel decided to build a winching apparatus that would reduce the time needed to pull a well, the safety hazards, and the physical strain on workers. The result of this endeavor is a well pulling unit that can be constructed at low cost, saves labor, and is far less hazardous to use.

The well pulling unit was made by modifying a 1-ton truck chassis with cab and engine. The basic concept was to use the engine and transmission to supply power to a double drum winch made from the rear axle assembly. The first step was to remove the rear axle and bolt it on top of the frame behind the cab. The axle was placed so that the front part of the two-part drive line could be connected to the differential using parts of the original universal joints. To make both sides of the axle assembly pull simultaneously, the spider gears in the differential were welded together. Wheel mounts and brake assemblies were left intact since the wheel mounts provided an easy means of attaching winch drums and the brake assemblies provided a ready-made winch drum braking system.

A cable spool was made from a 1-ft length of 12-inch pipe and two 5-inch flanges made from ¼-inch plate steel. This spool was welded to the outside of one 20-inch truck wheel which was attached to the wheel mounts on one side of the axle assembly. The 12-inch spool holds 150 ft of ⅜-inch cable and the lips of the wheel itself form a drum which will hold 150 ft of reserve cable. This winch drum is used as the pipe and sucker rod lifter. Using a crown sheave in the well tower and a single line direct pull (1-1 lifting ratio), 5,000 lb can be raised safely. For deep wells, where the load may exceed 5,000 lb, a double line pull, yielding a 2 to 1 lifting ratio, can be used. In this case the end of the cable is threaded through the crown sheave, then through a traveling sheave and the end attached to the crown sheave. The traveling sheave is then attached to the pipe to be lifted. The other end of the axle assembly was fitted with a winch drum made by welding 5-inch flanges to the outside lips of a 20-inch wheel (see end-view in photo B). This winch drum holds about 700 ft of ⅜-inch cable and is used when cleaning wells with a baler.

To facilitate transportation and maneuvering at well sites, the winch unit was made into a gooseneck trailer. The front axle and springs were removed and reattached at the rear of the frame in a position where the tires would clear the front of



Protected by a steel cage, pulling rig operator has a clear view of well head. The 12-inch, heavy duty winch drum on left holds 150 ft of ⅜-inch cable and the wheel to which it is attached holds 150 ft of reserve cable. The winch drum on the right holds 700 ft of ⅜-inch cable and is used in baling and other light load operations.

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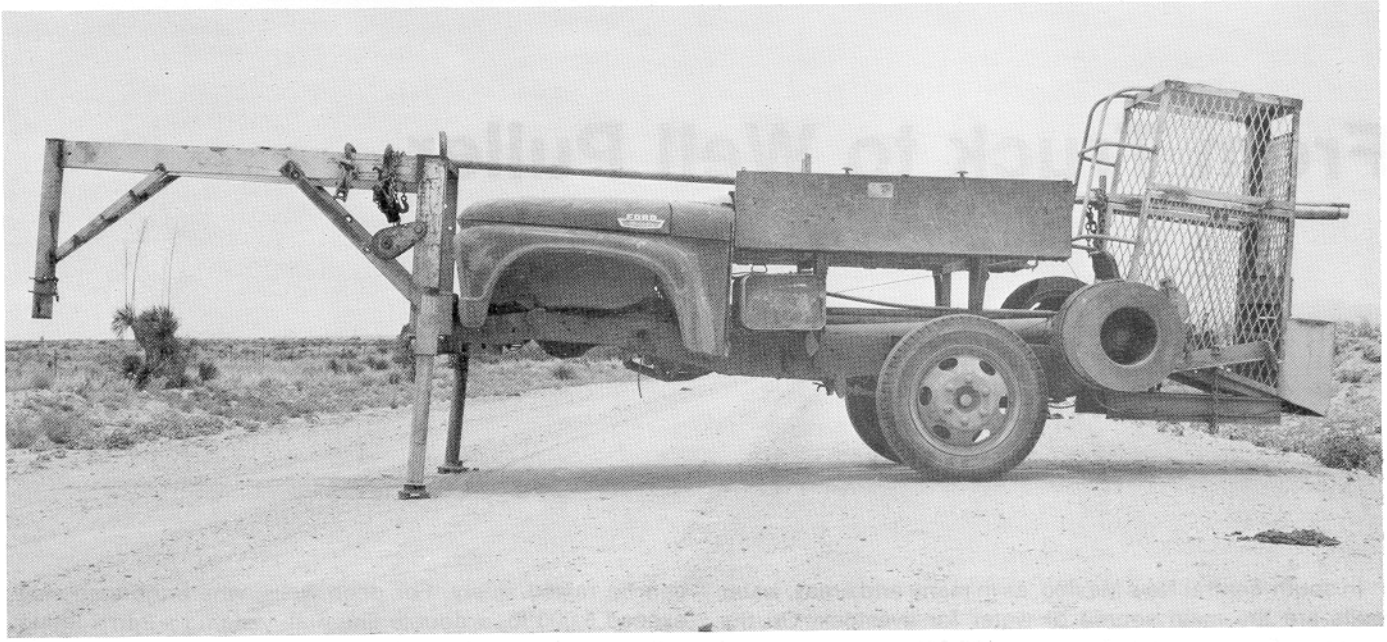

Well-pulling rig fabricated from truck chassis and engine has a gooseneck hitch for easy transport and maneuverability.

the winch drums. Brackets welded between tie-rod and axle locked the wheels in a straight-ahead position. A gooseneck hitch was fabricated from 6-inch channel iron with a piece of 4-inch pipe forming the front pivot riser. This hitch was welded to the front of the truck frame and reinforced with a 2-inch angle iron. A stand assembly was made to support the unit when not attached to a vehicle. Short sections of 3-inch pipe were welded to the ends of a 4-inch I-beam attached to the front of the frame. Adjustable legs made from 3-inch pipe slide in the 3½-inch pipe sections and are secured by locking pins in matched holes.

An operator's console, facing to the rear, was constructed at the rear of the trailer. A dashboard was made from channel iron and ⅛-inch steel plate. An on-off switch, starter switch, and throttle control were mounted on the dashboard. Swing pedals for operating the clutch and brakes were mounted under the dashboard. The clutch was made into a hydraulically actuated system by attaching a slave cylinder to the clutch throwout arm and connecting it to the clutch master cylinder through the old brake lines. The original brake master cylinder was mounted under the dashboard so that it was activated by the swing brake pedal. Brake lines connecting the master cylinder to the original drum brakes were installed. In addition, the original emergency brake control lever was installed in the operator's compartment and connected by cable to the emergency brake. The emergency brake is a useful feature because it can be used if the drum brakes fail, and it permits the operator to lock the winch drums in position if he must assist at the well head.

Using a length of ¾-inch pipe and a tie-rod end for linkage, the transmission shift lever was installed in the operator's compartment. Compound low and reverse are normally used in raising and lowering heavy loads of pipe, but the higher ratio gears are available for baling and light loads. Controls were positioned in relation to the operator's seat so that a normal driving attitude could be maintained and the operator would have a good view of well-head operations. A cage to protect the operator was fabricated from expanded metal and angle iron. Pivoting outrigger props were attached to the rear of the trailer frame. When released, the props strike the ground at an angle so that when the winches are pulling, the props are driven further into the ground and the unit cannot be dragged toward the well.

The truck cab was removed, leaving only front fenders and hood of the original body. The gas tank was moved into the former driver's seat area. Toolboxes to hold wrenches and spare well parts and racks for transporting lengths of pipe were attached to the sides of the trailer.

Using the unit, a well pulling job takes 20 to 25% less time than with the old cable-sheave-vehicle arrangement. Also, one less worker is needed on the crew. Much of the time saved is during setup and takedown, because the cables do not have to be uncoiled (or untangled) and coiled by hand. Pulling takes less time than with the old method because the operator can see what is going on, has a clear view of all operations, and is in voice contact with the workers at the well head.

The truck chassis used was surplus equipment; no cost figures are available. About $500 was spent on parts and welding supplies. We estimated that about 120 manhours were spent building the unit. Since the unit should last for many years, we think that a unit of this type would be a great help to the rancher who has several wells to maintain with limited manpower. ●