

Drive Two Tractors Instead Of One

by Frank Buckingham

Increasing the productivity of field work-time usually means using larger tractors and bigger implements. But it could also be done by one driver operating two unconnected tractors.

A master/slave tractor control system developed in Denmark by Svend Aage Christiansen, Agricultural University, Copenhagen, permits the driver on the master tractor to control a slave tractor working immediately behind or offset to either side.

Distance between tractors and the offset angle are maintained automatically and the engine speed of the slave tractor is proportional to the distance between units. If the distance between tractors decreases to a specified minimum, or exceeds a pre-determined maximum, the clutch and brakes of the slave are activated.

The clutch and brakes of the slave tractor are also remotely controlled by the driver of the master tractor, and are automatically applied in case of certain other equipment failures or malfunctions. The gear shift, hydraulic lift and differential lock of the slave are also controllable from the master tractor.

A hydraulic motor, controlled by a 4-way solenoid valve, turns the

steering wheel shaft of the slave tractor through an idler gear. Pneumatic cylinders control gear shifting, differential lock and fuel cutoff to the engine. The fuel cutoff is spring-loaded so that when there is no air pressure, the spring will automatically stop fuel flow to the engine. Diesel fuel is also cut off whenever the control button on the master tractor is pushed; when lubricating oil pressure drops too low; when engine coolant temperature gets too high; or when the electrical system fails.

An inductive connection system is used to control the slave tractor. A horizontal loop coil located on top of the cab of the master tractor carries an alternating current which produces an alternating magnetic field that is picked up by three sensing coils arranged in a horizontal triangle on top of the slave tractor. The voltage induced in the front center coil on the slave tractor measures distance between the two vehicles, and the ratio of that voltage to the voltage picked up in the other two coils mounted slightly to the rear and to each side of the tractor measure the offset angle of the slave from the master tractor. Remote control signals are carried by an amplitude modulation of the exciting



One driver (on front or master tractor) controls both tractors. Engine speed of slave tractor and its distance from master tractor is maintained automatically.

current.

Christiansen stresses that development of a master/slave control system requires particular attention to safety and the possibility of using the tractors separately. In fact, being able to use the tractors individually could be a prime advantage of buying a master/slave combination instead of a single larger tractor. For instance, if one machine in a master/slave team fails, the other could continue

operating compared to halting all field work if a single large tractor or machine is down.

The master/slave system developed by Christiansen is not available commercially in the U.S. or Denmark.

For more information, contact: FARM SHOW Followup, Svend Aage Christiansen, Senior Lecturer, Dept. of Agricultural Engineering, Agrove 10, 2630 Taastrup, Denmark.

RUNS AT HIGHWAY SPEEDS ON COMPRESSED AIR

Air-Powered Car First of Its Kind

Here's the latest new solution to the energy crisis — an air-powered car that speeds along at 32 mph for up to 10 mi. on just one 330 cu. ft. tank of compressed air.

The car's designer, Terry Miller, of Crestline, Kan., built the car in 16 weeks. "With improvements, and some research into windmill-powered air compressors, its performance and economy could be amazing," states Miller, who is helping air-power enthusiasts at his own expense by giving away complete do-it-yourself plans to anyone interested. He explains: "I want to see the idea developed. All I ask is a \$10 royalty for any cars sold commercially."

Thirty days after the car was introduced last fall, a manufacturer in nearby Riverton, Kan., had already begun gearing up to produce a commercial model. Meanwhile, a local machine shop began stamping out the large 45-in. gear which is at the center of the car's drive system.

Miller spent just \$884 to build his car, which actually works something like an air compressor in reverse. Air at 2250 psi is let out of the storage

tank, reduced by a regulator to 210 psi and fed into an actuating cylinder where it moves a piston attached to a crankshaft, just as exploding gasoline expands against pistons in an internal combustion engine.

The key to Miller's car, and what makes it different from attempts in the past to power vehicles with air, is his pressure equalization valve. It passes air from the first cylinder, which is now at a lower pressure, to a second piston of a different size, where 90% of the pressure is recovered and used over.

The crankshaft drives a large 45-in. main gear mounted at the center of the vehicle and that, in turn, transfers power to the 4-in. axle gear. Nearly all the parts are available from hardware stores, welding supply stores or farm supply outlets. The car has motorcycle and heavy-duty bicycle wheels, and seats two.

What power does the experimental unit have?

"We pulled a ½ ton pickup down the road," says Miller, but adds that "I can't really foresee the day when tractors and other farm equipment would be powered by air. The re-

quirements are simply too great." He sees the car as an errand vehicle, or possibly a commuter car in the cities.

Miller built himself a 2-stage air compressor for \$600 to compress the air, but says a commercial model capable of high pressures would cost around \$2000. At current prices, he says his car costs him 1½ cents a mile to run. With two air tanks mounted on the car — a total of 660 cu. ft. — he

can travel close to 20 mi.

"One amazing thing — this is the only car in the world that you can drive under water. There's no air intake and only air is exhausted," he points out.

You can send for free do-it-yourself engineering plans from Miller, complete with instructions on where to buy required parts. He'll also provide information on those now gearing up to manufacture the car.

For more details, send 25 cents (for postage) along with your inquiry to: FARM SHOW Followup, Terry Miller, Air Car, Box 80, Crestline, Kan. 66728 (ph 316 389-2299).

Large 45-in. gear transfers power to axle. Twin air tanks will run car 20 miles on one fill.

