

Robert H. Witt
Director of Engineering
Wheel Horse Products, Inc.

Benson J. Lamp
General Product Planning Manager
Massey-Ferguson Industries Ltd.

It's a **GROWING** Market . . .

Lawn and Garden Tractors and Outdoor Power Equipment

BY 1970 400,000 homeowners each year may be buying lawn and garden tractors to plow their gardens, mow and rake their lawns, clear snow from walks and driveways. In 1961 only 50,000 of these self-propelled riding vehicles designed for general purpose lawn and garden work were sold — last year that number had already climbed to 150,000.

The horsepower race is on, too. The median horsepower model in 1961 was 5 to 6 hp; this year it is 7 to 8 hp; by 1970 it is expected to be 10 to 12 hp.

Over 200 engineers will be designing these tractors by 1970. Many of these engineers will be in the employ of the manufacturers of the "big brother" farm and industrial tractors.

The opportunities are almost unlimited for creative designs to meet customer needs for the tractor and its implements.

Hydrostatic Drives for Small Tractors

This year a more advanced drive system — fulfilling most of the idealistic drive requirements for a small tractor and riding mower — has been introduced. Hydrostatic drives probably will achieve the acceptance on small tractors that the automatic transmission has on automobiles.

Hydrostatic drive provides:

- Infinite speed selection in forward and reverse

The authors, both ASAE members, participated in the Small Tractors and Power Equipment sessions at the recent annual meeting in Athens, Georgia. B. J. Lamp was the presiding officer; R. H. Witt participated in the symposium: "The Manufacturer Views Standardization."

- Direction control without shifting
- Hydraulic braking
- Hydraulic power for attachments
- Simple control of speed, direction and braking

This hydrostatic drive system consists of a variable-displacement hydraulic piston pump driving a fixed-displacement motor through a system of valves. Speed is proportional to the displacement setting of the piston pump, which is controlled through a swashplate. Tilting the swashplate through neutral into an opposite tilt automatically reverses the flow, providing reverse direction. A mechanical reduction from the motor drives the wheels through a standard differential.

Only the amount of oil required to produce a given speed is pumped and only at the pressure required to overcome friction and load.

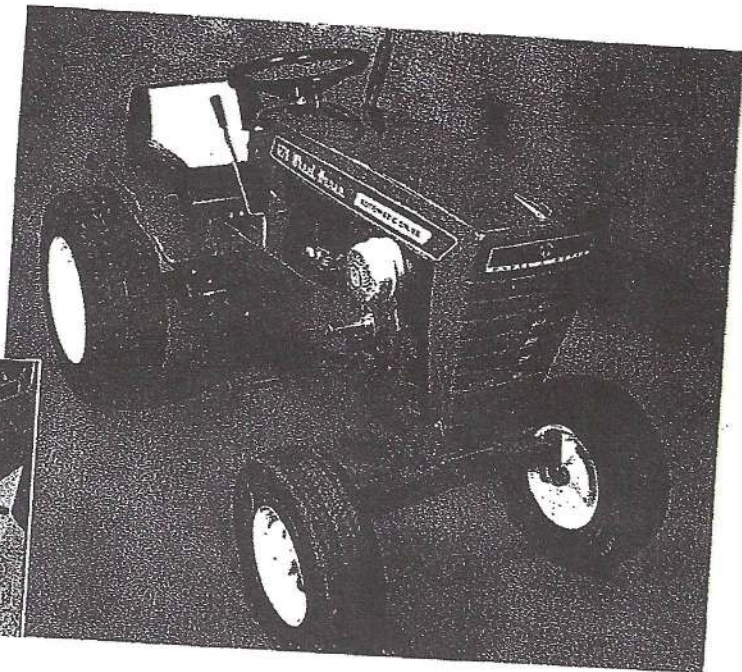
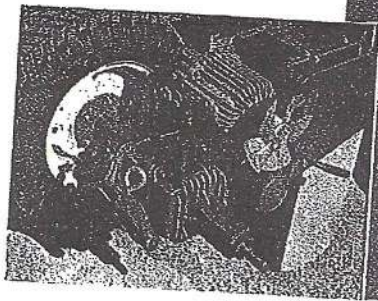
The hydrostatic transmission does not provide the overall efficiency of a regular mechanical transmission. This is not too important in garden tractors because about 95 percent of the time they will be used with attachments. Most of the engine power is then used by the mower, snow blower, or tiller rather than for tractive effort.

The hydrostatic transmission does exceed in work capacity. In mowing, a 20 percent time reduction is common because of easier maneuverability on any terrain. In blade or snow blowing the job can be done in half the time.

The Challenge of Safety

The safety-conscious parent who would never permit his 12-year old to drive the family car, use the trusted shotgun or the family workshop without strict supervision

Fig. 1 Hydrostatic drive tractor has hydrostatic unit manufactured by Sundstrand Corp. Direction, speed of travel and braking are controlled by hand lever. A foot pedal on opposite side overrides the handle control for emergency braking. Inset illustrates the "hydrogear". A small fan cools the pump element



thinks nothing of permitting that child to use the power mower, snow blower, or tractor.

With about 25,000,000 rotary mowers in use this equipment injures more people than all other lawn and garden equipment combined — estimates are between 50,000 and 100,000 per year.

Most lawn rotary mowers operate with a blade tip speed between 10,000 and 20,000 fpm. They can sling small objects at speeds over 200 mph — or twice the best recorded speed of Bob Feller's fast ball!

This is a major hazard of all rotary mowers, not only endangering the operator but anyone in the area. Danger exists at the discharge opening and all around the mower as objects can be deflected below the protective housing to ricochet off the ground.

Over 90 percent of all mower accidents are the result of operator negligence — about 25 percent of these occur to children operating these machines.

A common snowblower accident happens when the operator clears a plugged discharge chute with his hand while the machine is running and is caught by the impeller. Last winter 17 such hand injuries were reported in one city in a single snowstorm!

Riding mower and small tractor accidents are caused by upsets, by a second rider falling off, by backing over a child who has been following.

We find little comfort in the fact that over 90 percent of these accidents are the result of operator negligence. As engineers we have a tendency to excuse ourselves with such statements as "He didn't read the owner's manual," or "He didn't know the common rules of safe operation." But the question is: Does the average family have the time or the ability to read and retain all safety and operating rules?

We have a responsibility to make equipment that does not require extensive training for operator safety.

We have a moral obligation to help reduce these unnecessary accidents. And this challenge has been accepted by ASAE and the Outdoor Power Equipment

Institute, working with the National Safety Council and various government agencies.

First, the educational campaign will distribute through films and news releases for papers, radio and television hints on how to be a safe operator. Safety instruction cards are made available for manufacturers to distribute with owners' manuals.

Second, minimum design safety requirements are being established. These include design and test requirements for best safety consistent with good performance. And of course innovation is encouraged to create new and safer ways for doing these same jobs.

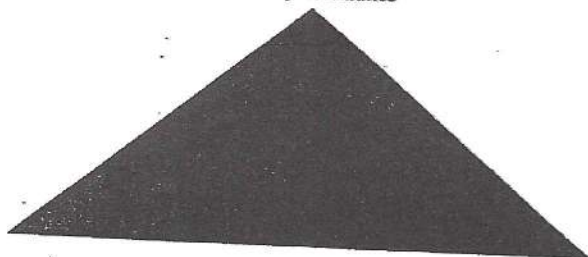
The first of these design standards was published in 1960 and revised in 1964. This was "Safety Specifications of Power Lawn Mowers", sponsored by the Outdoor Power Equipment Institute and published by the American Standards Association. Compliance with these standards will not make a machine incapable of injuring an operator or bystander — it does insure the customer that his machine is as safe — consistent with good performance — as the industry can make it.

Need for Industry Definition

American Society of Agricultural Engineers is responsible to the public — to the industry it represents — and to the engineers who serve that industry. But in this broad outdoor power equipment market whom do we

(Continued on page 447)

Fig. 2 This "Seal of Safety" indicates that the power mower represents the best available design for safety consistent with good performance



vato how to divide one-half cu.-sec. (225 U.S. gpm) between 50 to 100 men with plots aggregating in some instances more than 1,000 acres. Irrigation canals and division of water had been planned originally as a preventive against disastrous drought and not as a measure for a balanced agriculture. Drainage of much of the irrigated area also had little or no consideration. The flat alluvial lands of the cultivators were banded in plots of one-fourth to one-half acre size. Lack of ditches for drainage and no on-farm canals for irrigation made cropping difficult to impossible. Even with good natural or constructed outlets there were not planned systems to drain the farm lands of surface or subsurface water.

In contrast to the cultivators of the Gangetic plain, there is the story of soil and water management practiced for hundreds of years by a hardy, resourceful people who live in the Himalayas.

Nandi Devi, a peak of rock and snow 25,660 ft high, is above Bageshwar. This village on the River Kosi is in a valley in the northern corner of the Uttar Pradesh province of India which provides a buttress against the borders of China and Nepal.

The cultivators from Bageshwar each year win the first prize for the highest per acre production of rice in the entire province. The average production per acre of

paddy on the farms of Bageshwar is reported to be 45 maunds (one maund equals 82 lb), whereas the overall average is 15 maunds per acre. A record production of 100 maunds per acre, or 180 bu, has been reported for Bageshwar. (By way of comparison, Texas rice production in 1959 averaged 3,150 lb per acre, or 38 maunds.)

In the valley area of Bageshwar soil and fertility are anchored in place by carefully contoured, well placed rock bench terraces. Water is controlled by land leveling and smoothing and by providing protected waterways for the excess rainfall that comes during the summer monsoon.

Fertility and tilth of this productive soil have been maintained through the application twice yearly of two to three tons of composted manure per acre. From the steep slopes which are kept in forest cover, the farmers gather litter to provide bedding for the cattle in the sheds at the farmstead. The manure-saturated bedding material is then collected, composted, and placed in the fields to add organic matter and fertility to the soil.

With forest cover on the steep slopes, contour-bench terracing with leveling and smoothing of the tilled land, composts and fertilizers in the soil, and with management of water for irrigation, drainage, and erosion control, Bageshwar shows the way to better production in other hill and plain areas of India.

... Lawn and Garden Tractors

(Continued from page 437)

represent? Outdoor power equipment includes electric hedge clippers, trimmers, mowers, power vacuums, snow equipment, riding mowers, small tractors and commercial and golf course machines — produced by over 500 different manufacturers.

ASAE is most closely associated with one segment of this market, the lawn and garden tractor. But it will not best serve the public interest to have different definitions and standards apply to each machine family — or to divide machines or units of the industry up among various professional societies.

Such common definitions as *turning diameter*, *tread width*, *width of cut* should be the same for commercial mowers, small tractors, riding mowers, and other mobile equipment. Safety recommendations and safety markings should be consistent for all tools.

The majority of owners and manufacturers of this machinery have joined together (much as have farm and industrial equipment manufacturers) to form — the Outdoor Power Equipment Institute, or OPEI. The ethical objectives of our society can be best served if these great organizations work together. This engineering society can serve them all, rather than permitting piecemeal division between various groups. This merger would be no more difficult than the merger a few years ago of the Farm Equipment Institute and the Industrial Equipment Manufacturers.

The professional obligations of our society in this new market can be served if we

- Promote and actively participate in the union of advisory groups such as the FIEI and the OPEI to reduce unnecessary duplication, effort and conflicting standards

- Establish common definitions for specifications for all mobile equipment consistent with those established in the agricultural and industrial field, so that common terms such as turning diameter have common definition in all market areas
- Establish design, safety, and test standards; promote educational programs for safe operations
- Develop suggested design standards as necessary for expendable parts and, after market stability is achieved, for such items as drawbars, lift hitches, etc.

ASAE Committee Activity

ASAE, as the professional engineering representative of this industry, has a special responsibility. The PM-52 Small Tractor and Power Equipment Committee is now preparing recommendations for outdoor power equipment for home lawn and garden care.

Objectives of this committee are:

- To meet the professional needs of engineers engaged in the lawn and garden tractor and related power equipment industry
- To identify problems and to develop solutions which are in the public interest

The professional subcommittees include:

- Terminology subcommittee to prepare recommendations on definitions and nomenclature for the industry
- Tractor implement subcommittee to study problems of interchangeability of implements to tractors
- Safety subcommittee

Engineers from the principal manufacturers are active on these subcommittees.

Two technical programs have been sponsored by the committee and the third is scheduled at the ASAE Winter Meeting in Chicago. Engineers interested in taking part in committee activity may contact ASAE headquarters.