

**Agricultural  
Engineering®**



**50**

**OUTSTANDING  
INNOVATIONS  
1988**



# The Agricultural Engineering

Outstanding innovations  
in product or systems  
technology for 1988

## Saluting the AE 50

Acceptance in the marketplace is the highest accolade any new agricultural product can ever receive. But for innovative developments introduced last year, a singular honor is to be named one of The Agricultural Engineering 50 "outstanding innovations in product or systems technology for 1988," state industry designers and managers.

Showcased within this 32-page section are 50 top engineering developments in agriculture introduced during 1987. Virtually all companies supplying components, making products, or developing systems for food and agriculture were eligible to submit for consideration "developments that embody the application of new technology or the innovative application of an older technology."

Hundreds of "product nominations" vied for coveted spots among The AE 50. A distinguished panel of engineering experts from several well-known organizations reviewed entries to select those considered most likely to make "worthwhile contributions to the advancement of engineering technology in food and agriculture."

Agricultural Engineering magazine is proud to play an important part in making known these significant developments in engineering technology for helping farmers, processors, and equipment makers to cut costs, enhance quality, boost nutrition, become competitive, and improve profitability. To all firms — and especially to you honorees — here is our AE 50 Salute for 1988.

### **Aerovent Fan and Equip. Inc.**

*Microprocessor environmental controller*

### **Advanced Micro Systems Inc.**

*PC card provides four-axis motor control*

### **Agri-nautics**

*Venturi valve purges ag plane spray tanks*

### **Agri-Plastics Inc.**

*Chore cart with seamless plastic tub*

### **Amiad U.S.A. Inc.**

*Three-mode filter for low-volume irrigation*

### **Armstrong Tire Co.**

*Altered lug profiles damp tire vibration*

### **Atkins Technical Inc.**

*Thermocouple-fitted probe for process fluids*

### **Automated Environments Inc.**

*Computerized environmental control system*

### **Automata Inc.**

*Infrared analog/digital-data telemetry link*

### **Automotive Industries Ltd.**

*Cotton stalk uprooter and shredder*

### **Beckman Instruments Inc.**

*Scientific Instrument Div.*

*Software-driven spectrophotometer*

### **Bijur Lubricating Corp.**

*Portable battery-powered lube system*

### **Case IH**

*Big rect. baler melds 27 novel features*

### **Case IH**

*Four-model series of Magnum tractors*

### **Cat Pumps Corp.**

*Triplex ceramic plunger pump*

### **Claas of America Inc.**

*Cornhead-mounted flail chopper*

### **Decco Div.**

*Pennwalt Corp.*

*Tilt-roller fruit conveyor*

### **Deere & Co.**

*JD Des Moines Works*

*Cotton picker on-board lubrication system*

### **Deere & Co.**

*Des Moines Works*

*High-clearance grain drill with press wheels*

### **M. G. Dickey Industries Inc.**

*Subsoil applicator shanks in plant nutrients*

### **DICKEY-john Corp.**

*Electronic controller for custom chemicals*

### **Drossbach Agro-Drip Inc.**

*Ribbed heating tubes for greenhouses*

### **Dutton-Lainson Co.**

*Water-absorbing polymer filters fuel*

### **Eaton Corp.**

*Electric Drives Div.*

*Adjustable speed eddy-current drive*

### **Environmental Sys. Research Inst.**

*Soil/crop-data and mapping system*

### **Everest Interscience Inc.**

*Infrared multimeter displays CWSI data*

### **Farm-Oyl Co.**

*Multi-grade diesel engine oil*

### **Irrrometer Company Inc.**

*Remote tensiometric sensing stations*

### **KVP Systems Inc.**

*Plastic belting for spiral conveyors*

### **Key Technology Inc.**

*Force-balanced vibratory drive system*

### **Kool Korp.**

*Air-entrained water cools dairy cows*

### **Lenox Instrument Co.**

*Halogen-illuminated borescopic probe*

### **McDowell Manufacturing Co.**

*Div. of Alco Ind. Inc.*

*Pressure-locked irrigation pipe coupling*

### **Montano Manufacturing Inc.**

*Self-feeding wagon for six 1-ton bales*

### **Montano Manufacturing Inc.**

*Hay-cubing machine system*

### **Morris Rodweeder Co. Ltd.**

*Three-section packer/harrow toolbar*

### **Motorola Inc.**

*Control Products*

*Multi-mode irrigation telemetry system*

### **OMC/Lincoln/Ryan**

*Self-propelled turf aerator*

### **Parker Hannifin Corp.**

*Racor Div.*

*Mobile waste-oil/diesel-fuel blender*

### **Poly Tech Industries Inc.**

*Plastic-clad skid plates for grain headers*

### **Precision Growth Systems**

*Environmental control of greenhouse zones*

### **Renaldo's Sales & Service Inc.**

*Vegetable planter for plastic mulch beds*

### **Shurflo Div. (Carr-Griff)**

*Low-volume sprayer pump*

### **TRW Ross Gear Div.**

*Integral hydraulic motor/clutch*

### **Thern Inc.**

*Motor-powered hoist/winch module*

### **VE Corp.**

*Anaerobic pasteurizing/conditioning system*

### **Valcor Engineering Corp.**

*Solenoid valve for dispensing liquids*

### **Warrens Turf Professionals**

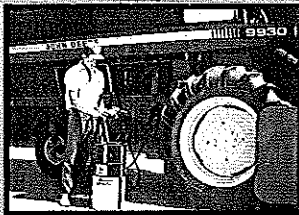
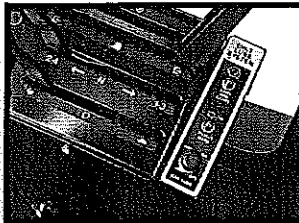
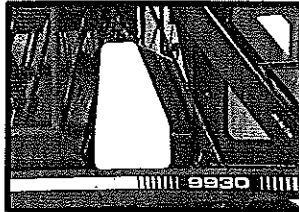
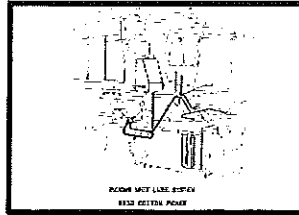
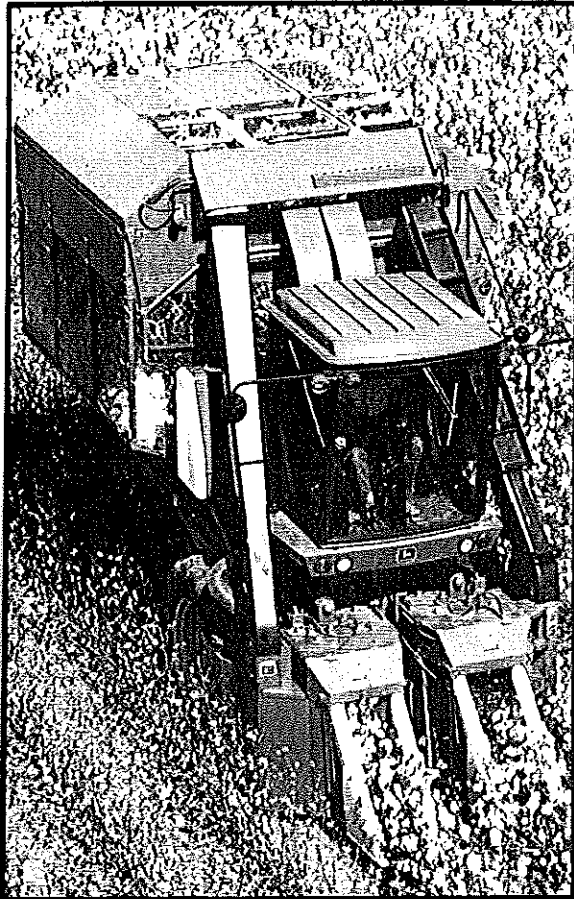
*Modular wall-type drainage system*

### **Weasler Engineering Inc.**

*PTO driveline shear device*

### **Western Telecomputing Corp.**

*PC-based control/instrumentation system*

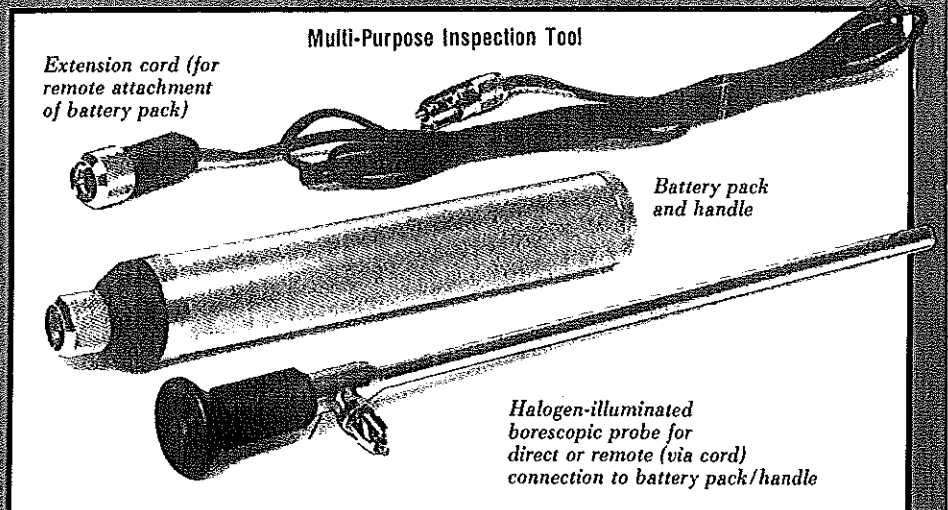


## Lube-Metering Lines Grease Picker Drums

Power dispensing system lubricates in less than 1.5 min the intricate cotton-picking mechanisms that previously required over 30 min to grease by manual methods. Originally introduced on a 4-row harvester, the on-board lubrication system for Deere's 2-row Model 9930 cotton picker carries a two-week supply for performing a lube job every 10 h. A transfer pump with coupler attachments (bottom inset view) can refill the system's 60-gal reservoir (second from top inset) in about 10 min. Two cab-based controls are used to activate the system when the picking units are warm from field operation. A floor-mounted lever triggers a 20-s burst of grease for drive and sun gears, cam tracks, and thrust washers. A console-located button actuates the 1-min lube sequence for bars and spindles on all four drums. Two console lights give visual indications that grease is flowing in response to the operation of a belt-driven, gear-type metering pump. An electric clutch engages this pump when the cotton picker's engine is idling at 1,000 rpm. The on-board system eliminates lube-service vehicles or areas, shortens maintenance and warm-up periods, and boosts on-the-row harvesting time. John Deere Des Moines Works, Des Moines, IA (515-289-3058) ■

## Small-Bore Viewer Illuminates Hidden Flaws

Diagnostic probe enables researchers, test engineers, and maintenance people to inspect visually—without time-consuming disassembly—the conditions inside engine cylinders, hydraulic actuators, and mechanical drives. A low-cost version of the borescopic devices now used for aircraft engines, the Autoscope consists of (top to bottom) a 6-ft long battery pack extension cord, stainless steel cylinder with three C-size batteries, and a 9.5-in. long probe that in turn has an eyepiece, 3x-optical lens system, and quartz-halogen light bulb. The high-intensity light source offers bright illumination of ports, recesses, and cavities. An adjustable-foam eyepiece atop the 5/16-in. diam probe reportedly delivers a 360-deg field of view. Lenox Instrument Co., Trarion, PA (215-322-9990) ■



Extension cord (for remote attachment of battery pack)

Multi-Purpose Inspection Tool

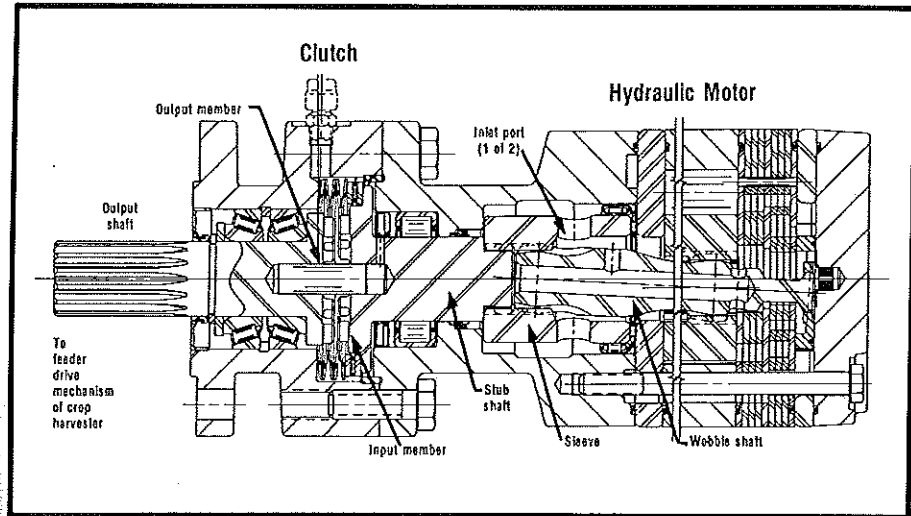
Battery pack and handle

Halogen-illuminated borescopic probe for direct or remote (via cord) connection to battery pack/handle



## Drive-Reversal Unit Frees Material Jams

**I**ntegral motor/clutch unit is normally an unactuated/disengaged assembly built into the drive system for a harvester's drag chains or feeder devices. But when activated, the unit must drive mechanisms in a reverse direction to dislodge jammed-up rocks or plant material. An operator first actuates a valve allowing full pressurization of passages and components inside the hydraulic motor. The wobble, sleeve, and stub members apply fluid pressure to a piston that imparts an axial clutch movement causing interdigitation (or lock-up) of teeth projecting from both clutch surfaces. TRW Ross Gear Div., Lafayette, IN (317-423-5377).

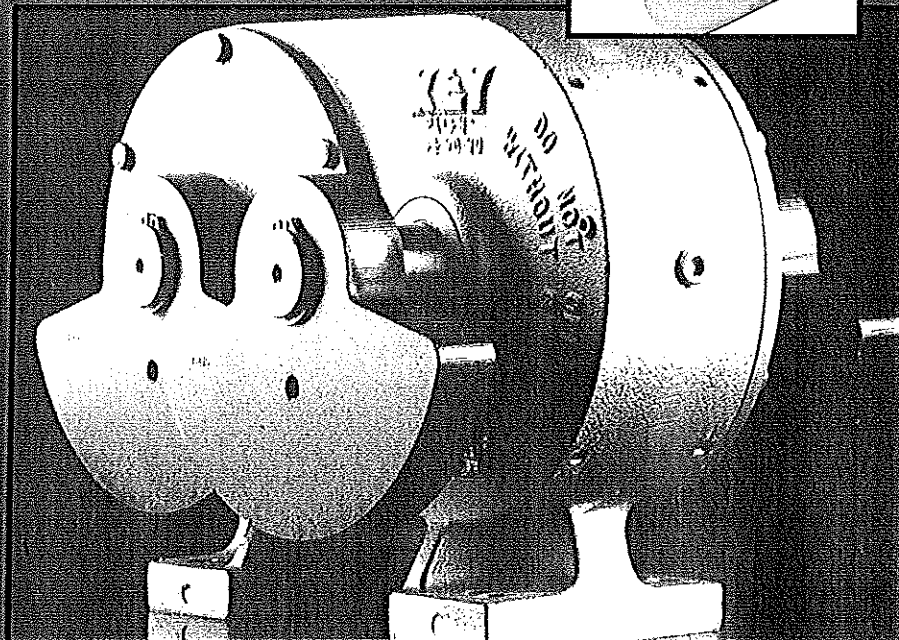
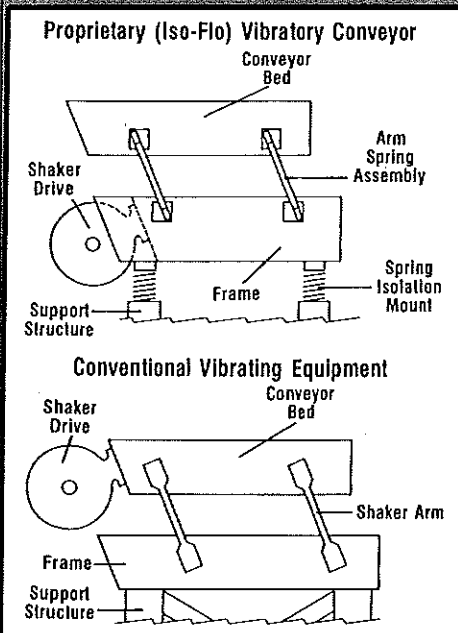
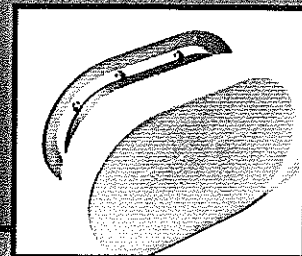


## Force-Balanced Shaker Energizes Vibratory Conveyor

**F**our gear-driven weights are featured on a flail-type apparatus that generates linear oscillating forces propelling vibratory conveyors in food processing plants. The energy-balanced design is claimed to eliminate the extraneous side-to-side forces experienced with a conventional drive having only two eccentric weights that rotate in opposite directions. The new Iso-Drive unit (shown with and without safety guards) employs two matched pairs of offset weights—that is, external weights mounted

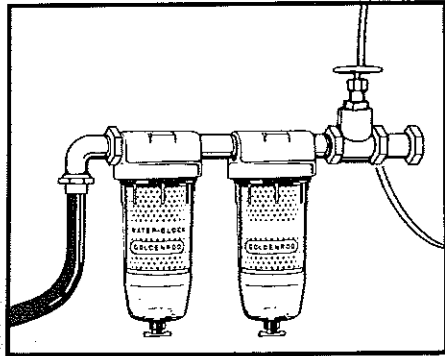
on both gearbox sides for each of two parallel shafts. This arrangement with four counter-rotating eccentric weights is said to facilitate set-up and calibration, curb skewed vibration, reduce conveyor noise, and prolong equipment life. An Iso-Drive gearbox has large-diameter shafts, tapered roller bearings, and composite material gears. The oscillatory or shaker-drive unit can be mounted on proprietary Iso-Flo vibratory conveyors (top diagram) as well as on conventional vibrating equipment used

in food processing and snack food industries. Key Technology Inc., Walla Walla, WA (509-529-2161).





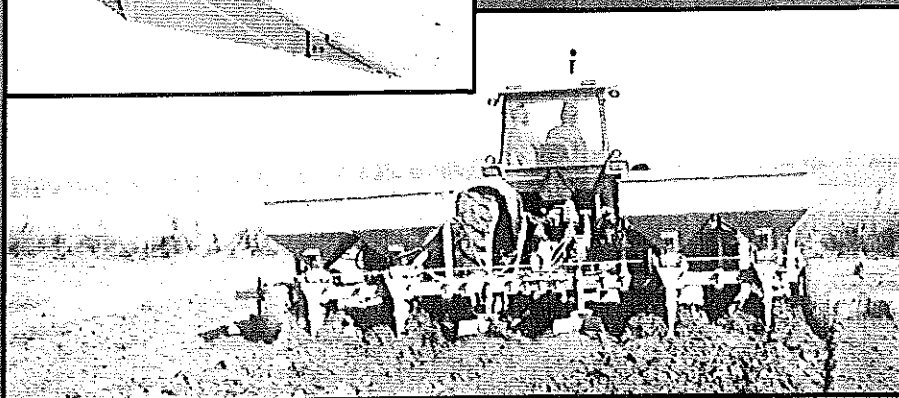
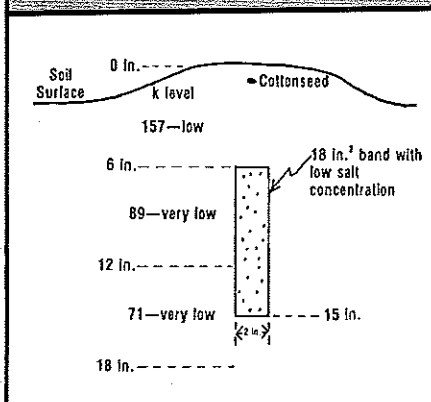
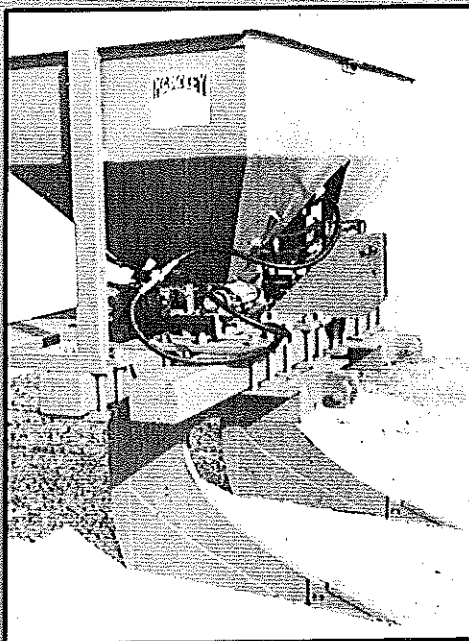
## Polymer Absorbs Fuel-Borne Water Molecules



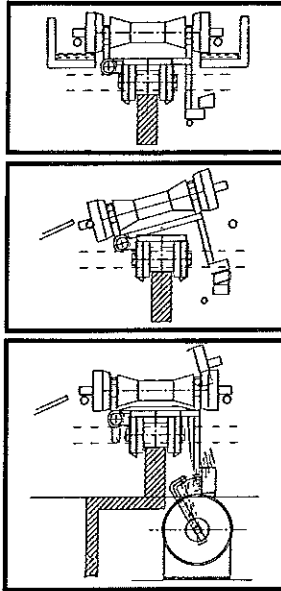
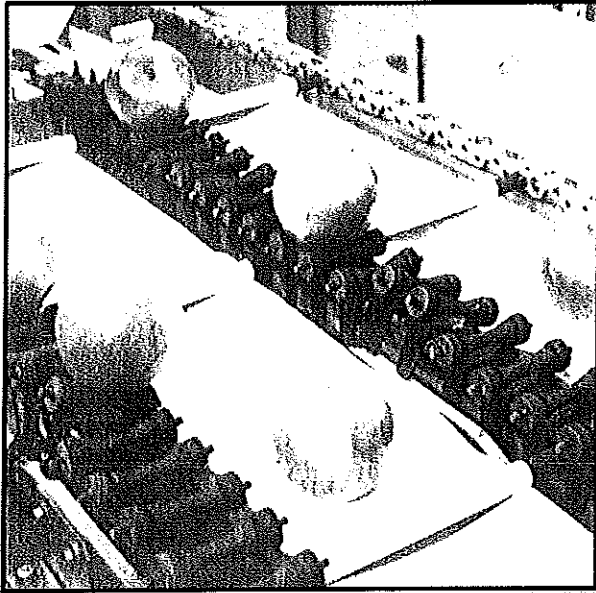
A water-absorbing polymer — like that used in disposable diapers for infants — is employed in cylindrical filter elements that remove molecules of water from

gasoline and diesel fuel. Previous filter designs could only trap droplets of water. Installed at the outlet of a storage tank, the new Water-Block filter absorbs molecular water as engine fuel flows to a vehicle's tank at a gravity flow rate of 5 gpm with a 24-in. head. After trapping about one-half cup of water, the unit begins to restrict fuel flow and thus signal the need to change the replaceable element. Water-absorbing media also provides filtration for 15-micron size particles and may be teamed with a companion 10-micron filter. The die cast zinc top cap is fitted with standard 1-in pipe threads for easy installation. The DL Goldenrod Water-Block filter is 9.5 in. high with a 4 in. diam, and made by Dutton-Lainson Co., Hastings, NE (402-462-4141).

## Subsoiler's Shanks Dispense Nutrients



Deep band applicator for dry lime and fertilizer helps to correct subsoil pH levels and nutrient deficiencies while providing a deep slot that enables the roots of cotton and soybean plants to reach ample water and nutrients during their critical fruiting periods. Based on a rig developed at the Delta Branch Experiment Station, Stoneville, MS, the new type of applicator delivers dry lime or fertilizer into vertical 2-in. wide by 9-in. deep slots left by chisel points mounted on the subsoiler's parabolic shanks. This arrangement is said to require less power than straight shanks working to the same depth, and to take much less energy than deep moldboard plowing to incorporate surface-applied lime and fertilizer. A variable-speed hydraulic motor drives a mesh-type conveyor chain that meters dry lime or fertilizer from each 18.6 ft<sup>3</sup> hopper into tapered delivery tubes for each row of a 2-, 4-, or 6-shank machine. The delivery tubes have internal deflector plates set to deliver one-third of the material at each of three depths: 6, 9 and 15-in. Due to shank curvature, displaced soil first closes the tube's lowest dispensing slot so that materials deposited at the upper levels do not fall to the bottom. M.G. Diekey Industries, Inc., Bastrop, LA (318-281-6143).

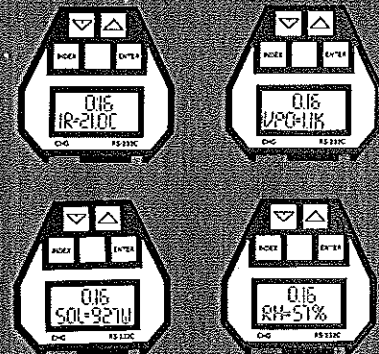
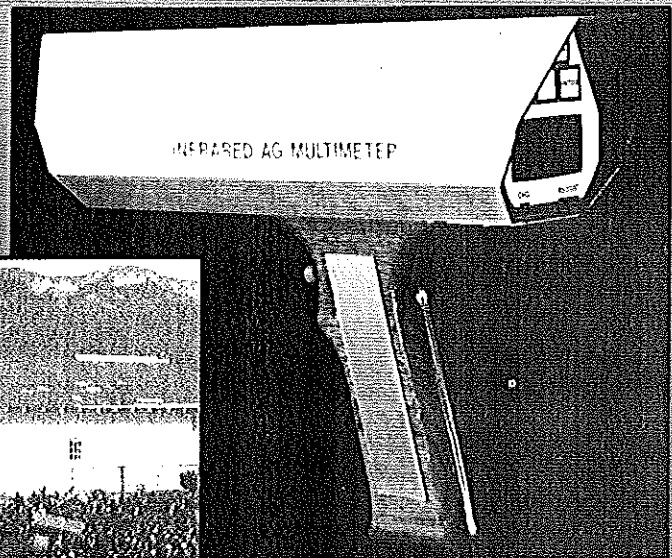
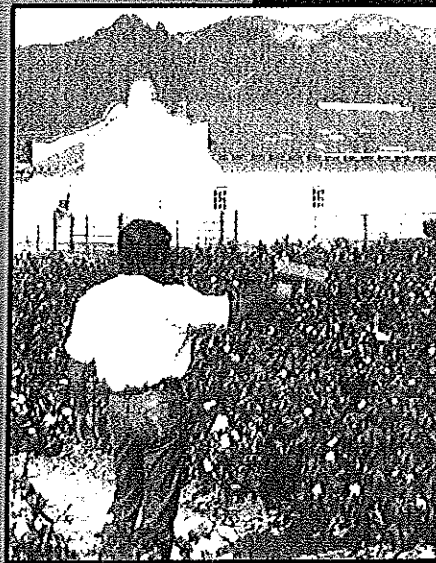


## Tilt Roller Conveyor

Pairs of tiltable rollers cradle and transport fruit past electronic size/grade/color sensing equipment that analyzes each piece of fresh market fruit. Fruit release instructions are transmitted to the appropriate pair of rollers through an electronic computer system. At a programmed drop-out location, the rollers tilt in unison to discharge fruit onto specially designed protective mats and the take-away conveyor. The spool-shaped rollers are claimed to carry more fruit in the same lateral space than cup conveyors running at the same speed, and they provide 80-90% exposure of total fruit surface for color sorting by optical devices positioned on either side. A CAD program proved the tiltable roller theory before a prototype was built, reports the Decco Div. of Pennwalt Corp., Monrovia, CA (818-358-1838). ■

## Multimeter Tracks Six Factors

Six field parameters can now be measured with a single instrument the size of previous hand-held infrared thermometers. The Ag Multimeter from Everest Interscience Inc., Fullerton, CA, (714-992-4461), can be used on crops such as corn, cotton, wheat, alfalfa, tomatoes, soybeans, tree crops such as pecans and citrus, and on turf. Claimed to be the first self-contained, microcomputer-based infrared multimeter on the market, the hand-held device gives a continuous display of the Crop Water Stress Index (CWSI) which permits irrigation scheduling when plants need water (independent of environmental conditions). No auxiliary equipment or supplies are needed and there's no need to take CWSI kits, data loggers, computers and other equipment to the field to make a variety of measurements. A memory chip permits storage of information (up to 400 records) for downloading into a computer for later analysis or record keeping. The Ag Multimeter scrolls sequentially at the rate of 1/6 the instrument's readings of a crop canopy's surface infrared temperature, dry bulb air temperature, relative humidity, vapor pressure deficit, solar radiation, temperature differential, and battery charge status. ■





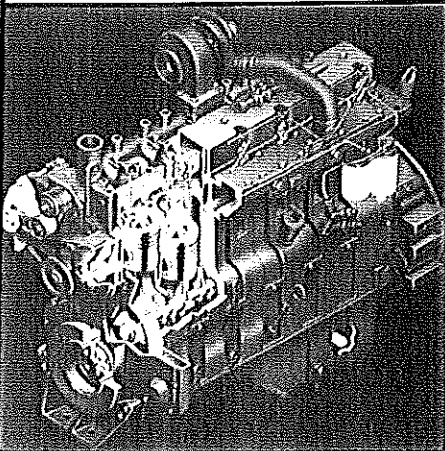
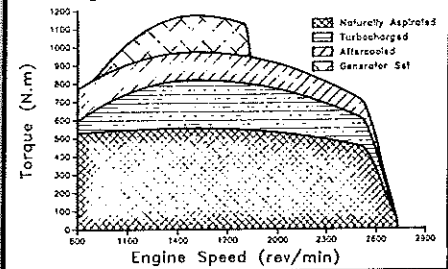






**Joint venture** between Case IH and Cummins Engine Co. led to the formation of Consolidated Diesel Co. and subsequent development of 505 in.<sup>3</sup> engines with 90% parts commonality across four levels of aspiration performance. Ultra-short exhaust ports have minimal contact with coolant jackets, thereby rejecting 12 to 20% less heat and channeling more energy to a turbocharger. Four Magnum powerplants deliver 130, 150, 170, and 195 pto hp. ■

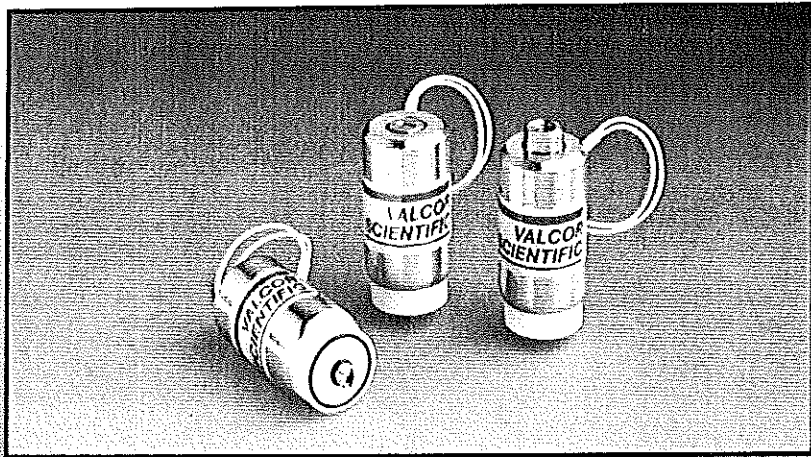
### An Engine's Four Operating Envelopes



## Plastic Bodies Guide Tiny Solenoid Valves

**F**luid-dispensing valves feature 0.8-in.-diam homopolymer acetal bodies molded with threaded inserts and external trim of stainless steel. These tough, stable thermoplastic valves with excellent creep resistance and high fatigue endurance require only 2 W to actuate tiny solenoids that cycle up to 40 times/s and reportedly offer over 250-million cycles/unit. Such

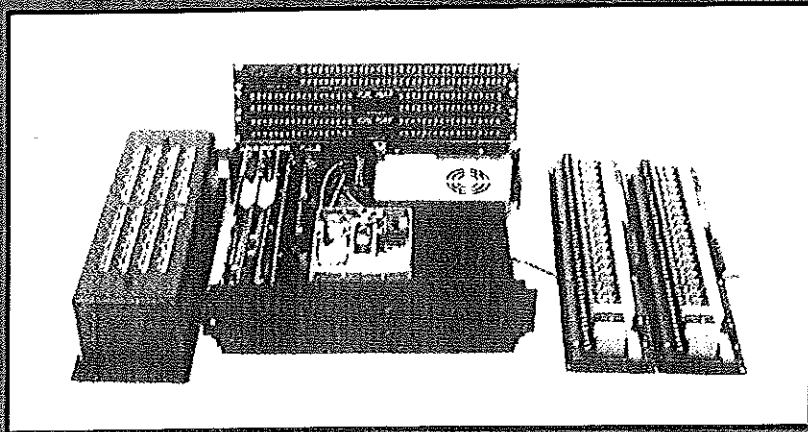
capabilities facilitate programmable digital pneumatic control and give lifespans like those associated with solid-state relays; however, the low-cost valves are considered most applicable for pilot operation of bigger fluid-handling valves and for the overall control of liquid-sampling systems. Valcor Scientific Div., Valcor Engineering Corp., Springfield, NJ (201-467-8400). ■



## PC-Based System Handles 64-Site Network

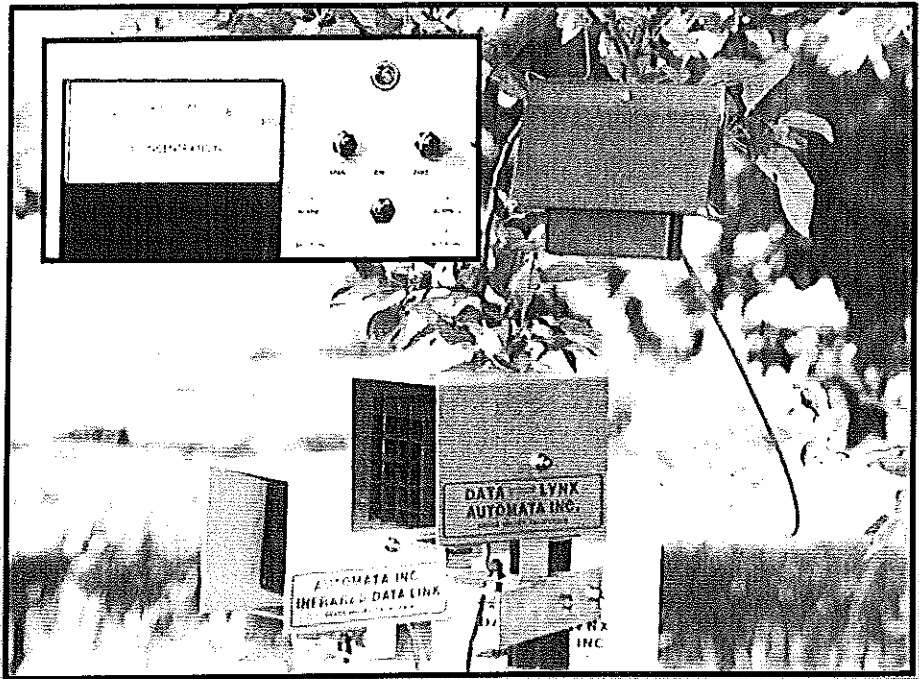
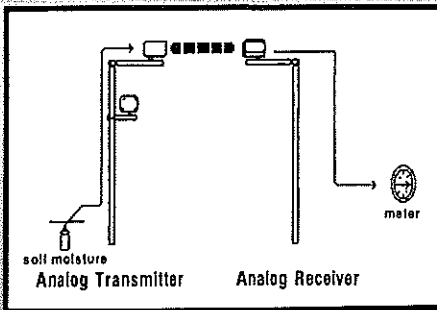
**S**ixty-four different alarms can now be issued via a special rack-mounted card for an Integrated Control and Instrumentation System (ICIS) offered by Western Telecomputing Corp., Bozeman, MT (406-586-1511). Whenever conditions at as many as 64 remote sites move above or below user-set threshold values, the addition alarms card for ICIS can employ an RS-232

information), radio links (for generating synthesized voice messages), or telephone modem. These data-receiving and condition-warning capabilities via personal computer may be extended to include process-control functions for environmental equipment in greenhouses, meteorological stations tied to field installations, and pollution-monitoring devices for air and water quality within a 64-site network. ■



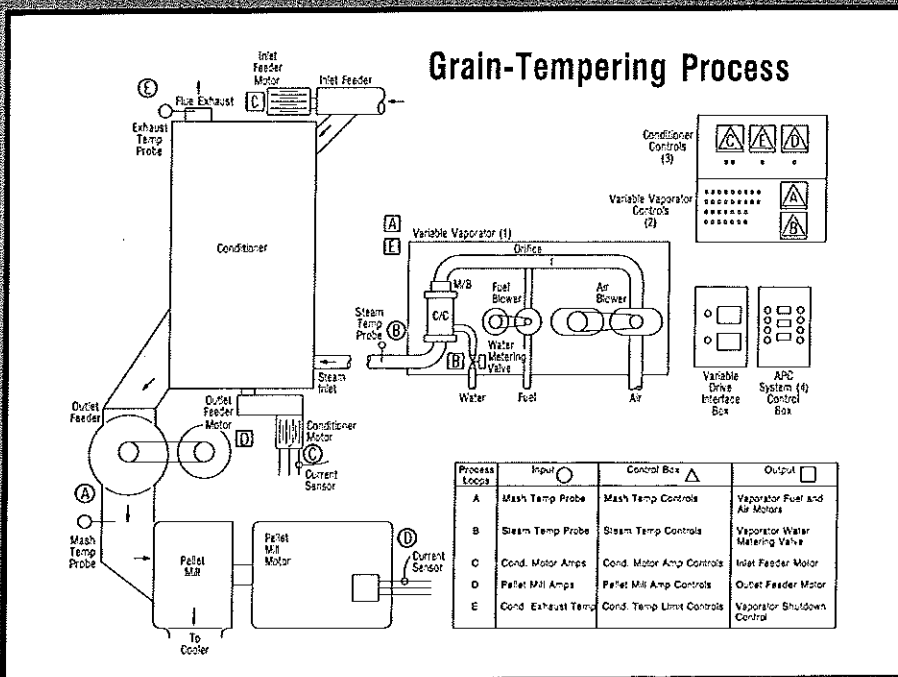
## Optical Data Links Report Field Status

Light beams can now replace radio waves and electrical wires for carrying analog as well as digital data from remote field units to central base stations. The information about air temperature, soil moisture, insect population, and equipment/water status is first collected by various types of sensors. Their condition-revealing electrical impulses are then converted to optical waveforms by electro-optic devices housed inside a post-mounted transmitter. Next, the data-encoded optical signals are beamed on a line-of-sight basis to a receiver located up to 1 mi away. Devices inside the receiver return the signals from far-flung sensors to electrical form so they



can be stored in the memory of a process-control computer, inputted as analog values to a programmable logic controller, or even used to trigger readings on the dials of remote meters (inset photo). An analog provision extends the infrared telemetry

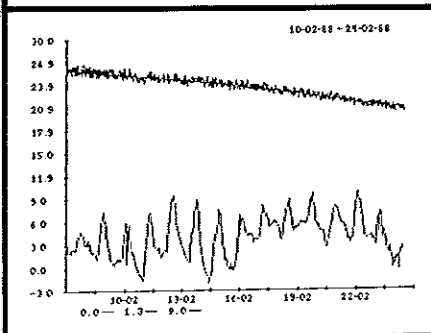
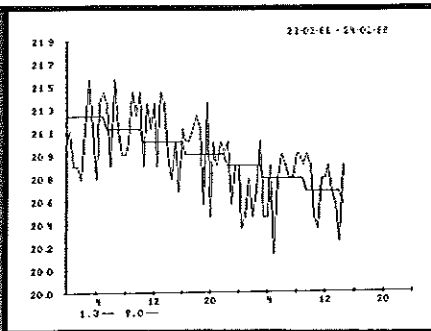
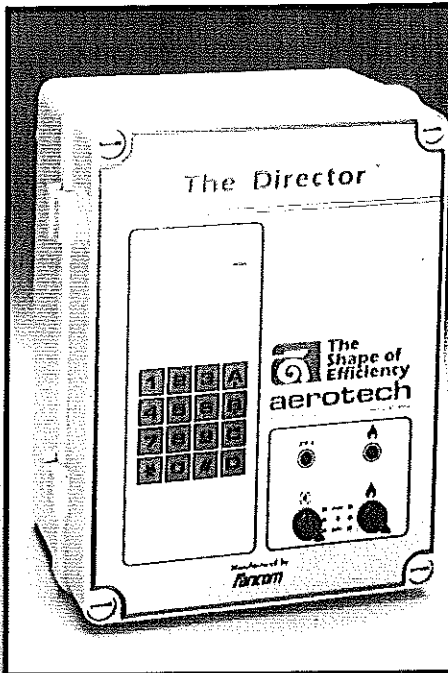
capabilities of Data  $\leftrightarrow$  Lynx equipment already made by Automata Inc., Grass Valley, CA (916-273-0380). Infrared links can thus supplant many systems featuring interference-prone radio waves and maintenance-plagued electrical wires. ■



## Huge Grain Cooker Boosts Feeding Value

Nutritional value of animal feed grains is enhanced by "steam cooking" the product in an oxygenated chamber before running it through a pelleting or steamflaking mill. The grain-tempering process, called anaerobic pasteurizing conditioning (APC), is claimed to denature protein, make starches more readily available, and destroy most unwanted microorganisms. Grain introduced to the APC system flows down through a huge cylindrical chamber while direct-fired boiler steam mixed with anaerobic live gas is directed up through the grain mass. Accounting for five patents, this new vertical conditioner design with a counter-flow heat exchanger can alter the tempering process via independent control of grain retention time, core product temperature, and steam moisture percentage. V&V Corp., Abilene, TX (817-640-9849). ■



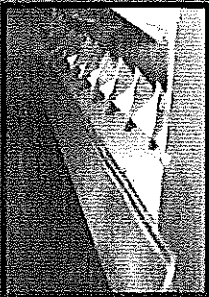


## Self-Adjusting Unit Programs Ventilation

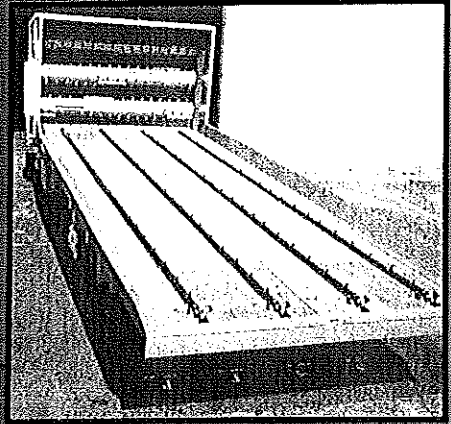
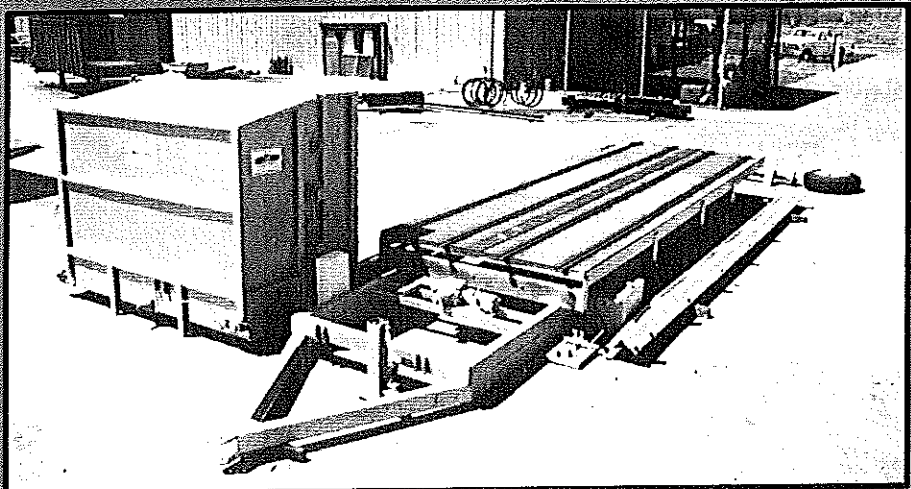
Microprocessor-based unit offers a choice between two basic control strategies for operating the ventilation equipment in structures used mainly to produce eggs, hogs, and plants. When set to maintain a constant temperature level, the Director environmental controller responds to outside temperature changes by detecting inside variations as small as 0.2°F and issuing the proper combination of corrective signals to inlet baffles, sidewall curtains, circulation fans, heating units, and cooling pumps. The controller can also be programmed to orchestrate progressive changes over a given number of days or weeks. When set for this mode, the current (starting) and desired future (ending) values trigger incremental (hourly or daily) changes in air temperature and circulation rate. Aerovent Fan & Equipment Inc., Lansing, MI (517-323-2930).

## Hay-Slashing Knives Shred Massive Bales

Hay packed into 1-ton rectangular bales for highway transport must be unwadded before giving it to cattle. Built to hold six 3 x 4 x 4-ft bales, the feeder trailer is designed to shred the ends of two side-by-side bales and eject their fragments into fence-line bunk or troughs. During trailer operation, all bales are first moved along the floor with four cleated chains driven by a remote hydraulic motor. Presenting a 32-ft



frontal surface, the six-bale pad is forced against three knife-studded cylinders powered by a tractor's pto. The sharpened double-edge knives are housed inside a trailer-front steel enclosure where they impart an aggressive hay-slashing action to the matted fibrous roughage. Cut material falls to a transverse conveyor, then moves to a shielded discharge area. This bunk delivery port, which consists of fabric mounted on a spring-loaded frame, serves as a foldable windguard designed to prevent animal injury and machine damage. Montano Mfg. Co., Merced, CA (209-383-1443).



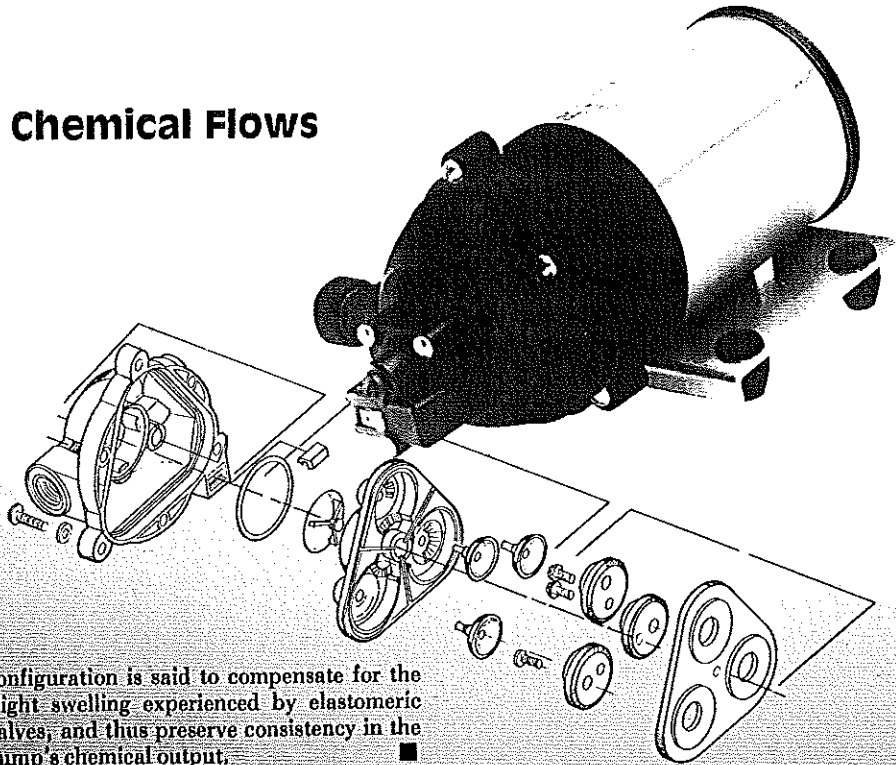




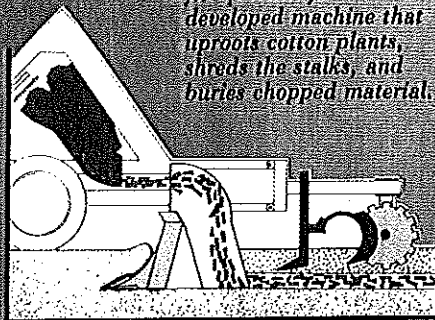
## Conical Valves Preserve Chemical Flows

Three conical inlet valves, an elastomeric diaphragm, and a discharge valve are key elements of pump-head assembly (sketch) developed by the Carr-Griff Div. of SHURflo, Santa Ana, CA (714-554-7709). This positive-displacement apparatus is connected to an eccentric-type wobbler drive that, in turn, is powered by an integral electric motor (picture). Choices of motor types for the assembly include 12, 24, and 36-VDC versions as well as 115 and 230-VAC options. The 4.2-lb motor-driven 8000 series pump can deliver flow rates up to 2 gpm, offer pressures of 0 to 100 psi, and handle fluids as hot as 170°F. Overall motor/pump unit is built to spray chemicals (on a spot or limited basis), transfer liquids, and dispense water. Major design improvements consist of changing from flat to cone-shaped inlet valves, adopting tough Santoprene material for the diaphragm, and incorporating an adjustable pressure shut-off device. The change in valve

configuration is said to compensate for the slight swelling experienced by elastomeric valves, and thus preserve consistency in the pump's chemical output. ■

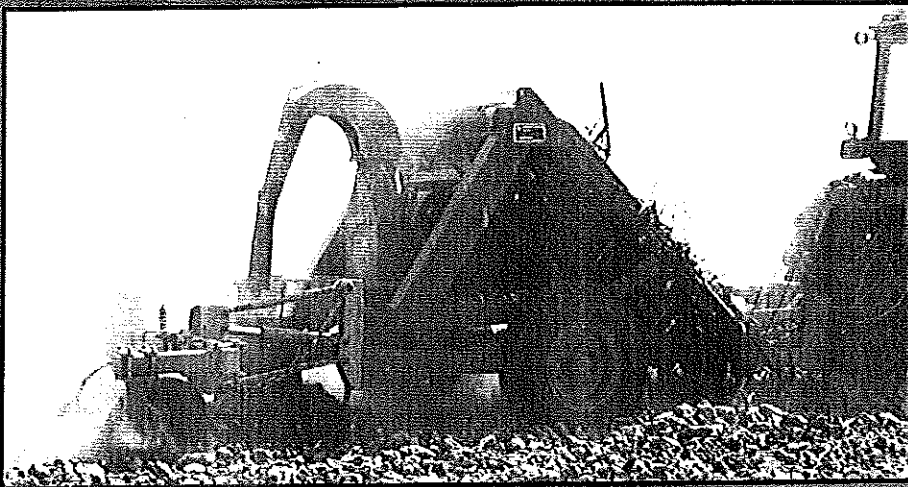


*Five nations have issued five patents for an Israel-developed machine that uproots cotton plants, shreds the stalks, and buries chopped material.*

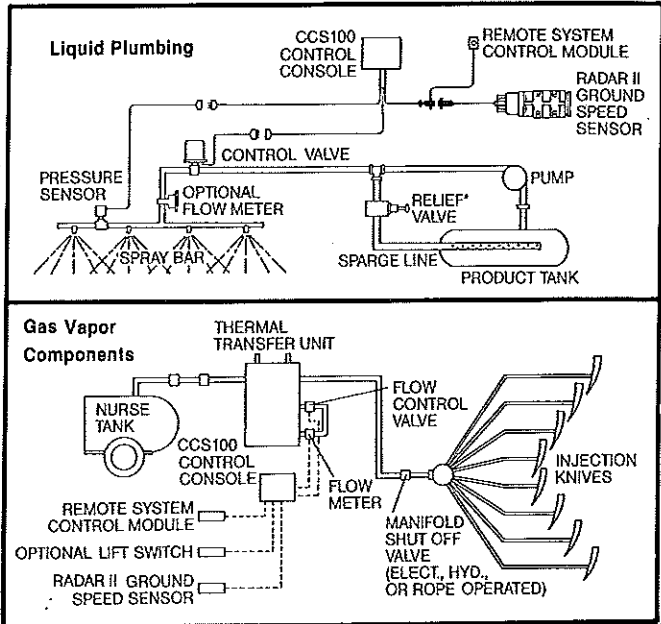
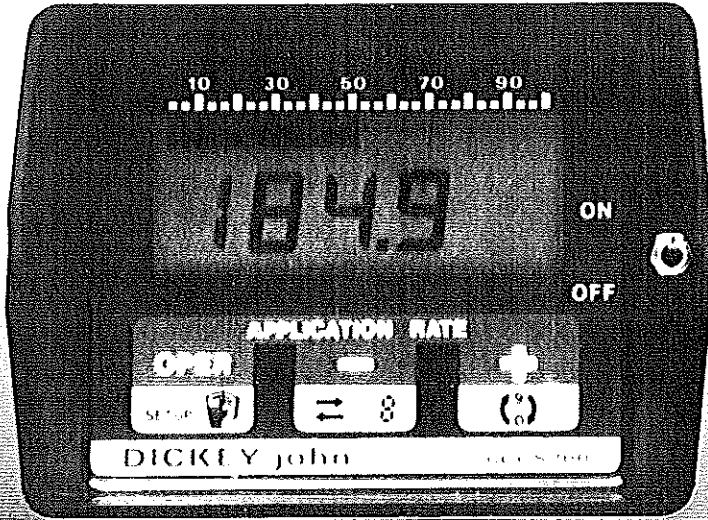


## Stalk-Chopping Rig Reworks Cotton Beds

Multi-function machine accomplishes in one pass the soil/plant manipulations that often require five trips over a cotton field. Developed jointly by industry and university ag engineers in Israel, the uprooter-shredder-mulcher (designated USM) machine plus attachments can perform a conventional system's shredding, plowing, disking, floating, and bedding tasks. The cotton roots and stalks from two post-harvest rows are uprooted by two pairs of counter-rotating rubber wheels, gripped by V-belt conveyors, and delivered to two sets of chain-driven feed rollers. The rollers feed root-attached cotton stalks to an eight-knife cutting cylinder (diagram), which chops the plant material into 1 to 1.5-in. lengths for subsequent disposal. In one machine option (shown), the shredded material goes to a subsoller that—along with two chisel points and two curved discs—buries it down to 12 in. deep (for subsurface mulch), tills the soil, and reshapes bed surfaces. Chopped plant material can also be dropped on the soil surface or blown into a trailer for use as feed or fuel. The USM machine has received five patents. S. Ben Dor Agricultural Machinery Div. of Automotive Industries Ltd., Van Nuys, CA (818-989-5862) ■







## Rate-Checking Unit Alters Chemical Flow

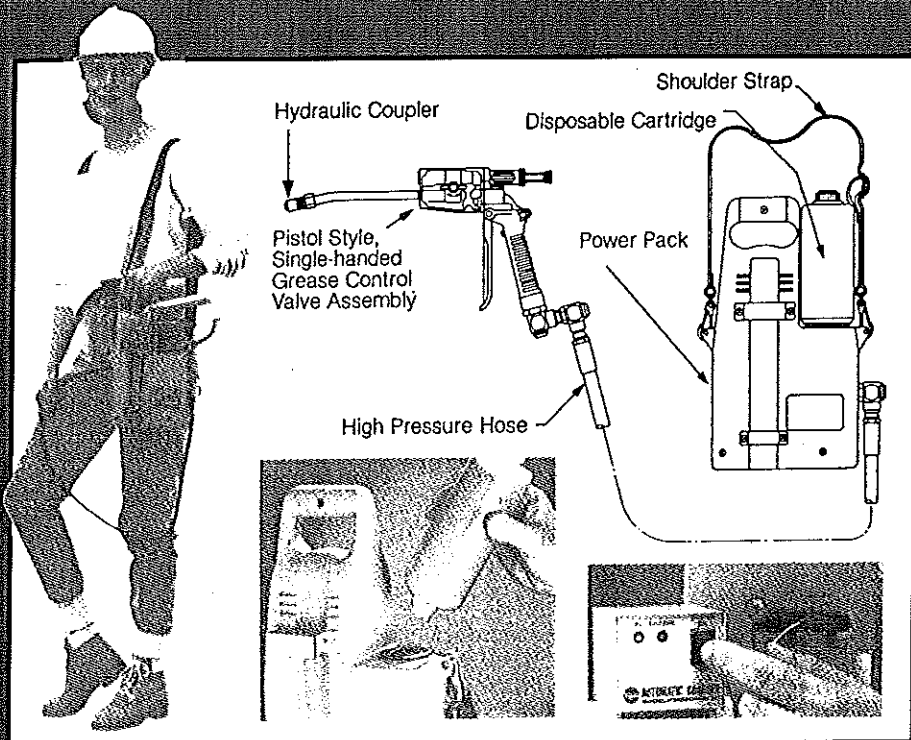
An adaptive control system for tractor-towed chemical applicators can rapidly change a rig's spray (or injection) rates to keep nozzle (or knife) outputs aligned with reference amounts programmed into the

electronic system's nonvolatile memory. The field-going computations of spray/injection rates are made by a console-housed microprocessor, which accepts two streams of data: 1. Ground speed information supplied by a microwave transceiver. 2. Chemical output indications from a pressure transducer in liquid lines (upper diagram), or from a flow sensor in NH<sub>3</sub> vapor systems

(lower diagram). Upon detecting any deviation from desired application rates, the microprocessor generates appropriate signals to a flow-adjusting electrohydraulic valve that can move from wide open to fully closed in less than 2 s to fine-tune chemical outputs. The CCS 100 control system was developed by DICKEY-john Corp. of Auburn, IL (217-438-3371).

## Rechargeable Rig for Remote Lube Jobs

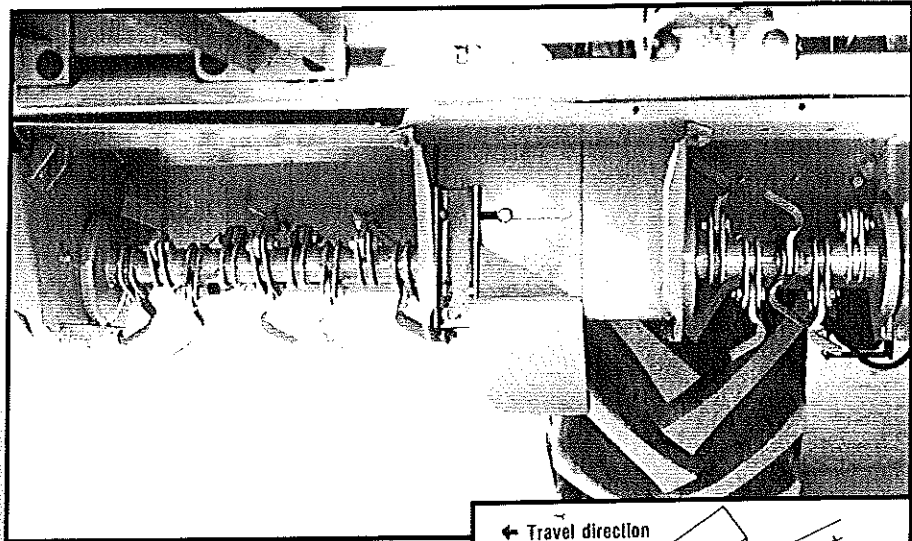
Great capacity and developed from 1500 to 2000 psi for injecting great amounts of lubricant into remote fittings aboard power machinery and off-road equipment. The 11-lb self-contained rig can apply 1000 psi grease on either a dual or triple 200-ton rig, or when set for 200 psi, the rig can inject a standard electrical cable or charging rod for 4 ft with a 315 VAC/15-AMP battery driver. An internal battery powers a electric motor that in turn drives a high-pressure pump for dispensing a variety of standard lithium or calcium-based greases. From 7500 No. 00 to No. 2000, a temperature range of 15 to 125°F. A disposable cartridge inserted into the rig's top supplies 400 cc of lubricant and can be changed through a hose to a plastic pump gun that can be set to dispense from 1/2 to 2.2 cc of grease. The rig is sold by Dickey-John Corp., Des Moines, IA (515-281-1174).



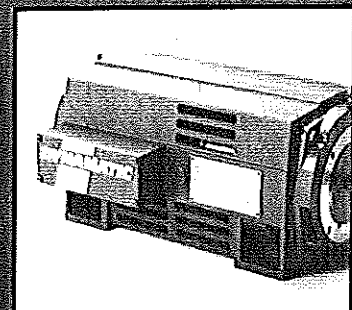
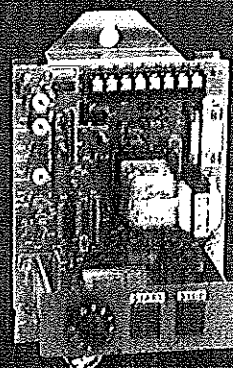
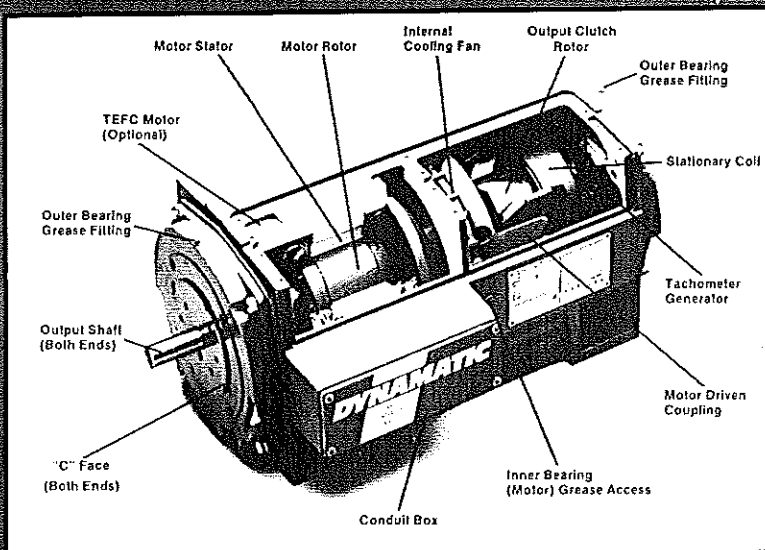
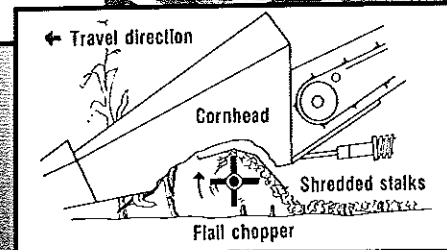


## Row Header Snaps Ears, Chops Stalks

Stalk-chopping attachments enable four and six-row cornheads to shred plant material after the ears of corn have been detached for subsequent processing in Claas combine harvesters. Mounted aft and below a cornhead's ear-gathering units are sets of hinged diagonal knives that rotate in undershot fashion relative to the combine's travel direction. By cutting into the cornhead-restrained stalks, the multi-knife flail rotors deliver an aggressive chopping action that shreds all stalks, destroys various pest havens, and spreads the chopped debris. A "Pick-N-Chop" equipped combine thus extracts shelled corn from a field while leaving a residue-covered surface ready for fall plowing or to resist over-wintering soil erosion. Adjustable skid plates determine the stalk-cutting heights of flail rotor sections, which also employ spring mountings "to float" independently of the cornhead heights. Shafts within the flail rotors are supported with cover-sealed bearings, connected between sections via flexible couplings, and powered by cogged drive



belts. These severe-duty belts are rated for high shock loads, tight bends over small pulleys, big speed reductions, and compact overall designs. Chopper units can be set for corn rows spaced 28, 30, or 32 in. apart, reports Claas of America Inc., Columbus, IN (812-342-4441).



## Field-coupled Clutch Adjusts Drive Speed

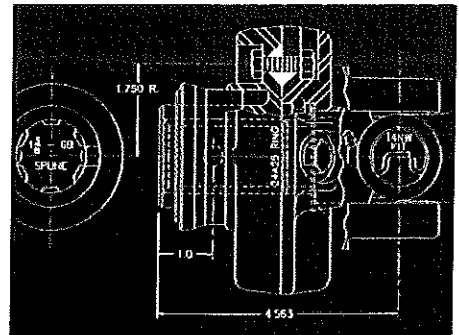
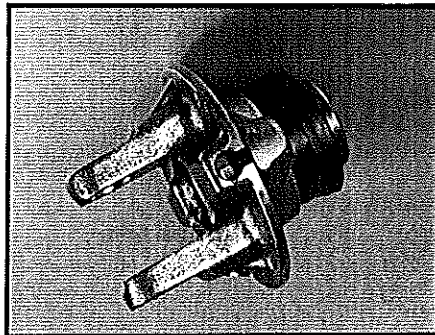
Only 1% of AC line power is wasted through a solid-state controller that varies from zero to base frequency. The output stage of an internal motor clutch provides the radiation-hardened electric drive that is applied for food processing

machines (mixers, blenders, and extruders), packaging equipment (conveyors, balers, and unscramblers), and material-handling applications (conveyors, lifts, etc.). Powered by a 10- to 200-hp AC induction synchronous motor, the Dynamatic AS drive features a smooth, easy-

control clutch in which the input and output members are coupled only through an aluminum-clutch field. Output speed is a direct function of load strength, and it is possible to obtain adjustable speed in constant torque or variable torque over the complete speed range. Speed selection by the adjustable drive can be set with the remote controller located up to 500 ft away or may be programmed for automatic regulation via a tachometer-activated feedback circuit. Overall design is aimed to keep the output speed within 3% of preset levels, to handle momentary overload up to 250%, and to provide a 60% speed reserve at rated torque. Dynamatic Drive Div. of GenCorp, Kenosha, WI (800-256-5071).

## PTO Shear Bolt Fits Intersecting Slots

Recessed within the periphery of a flanged tractor yoke is a bolt-type shear device for protecting implement drivelines from overloads. Primary function of the bolt is to join the yoke's input and output members. These facing members with hardened edges also create a shear plane for fracturing the bolt—a protective action that occurs whenever an operating load exceeds the device's rated torque level. Free rotation of the shear-released hub is then allowed via ball bearings incorporated into the so-called "ball shear device," which is available from Weasler Engineering Inc., West Bend, WI (414-338-2161). According to senior staff engineer Roger D. Mayhew, a major objective of product design was to comply with the fastener protrusion/yoke recess stipulations of Paragraph 8.4 within ASAE



S318.10, "Safety for Agricultural Equipment." The American Society of Agricultural Engineers issued the latest revision of this important safety standard in April 1988. Weasler's design eliminates protruding elements on its ball shear device by means of right-angle holes. A radial keyhole-shaped port in the yoke flange accepts a nut-type fastener. An axial hole through the hub element admits a 1-in. long

threaded bolt. This mating/clamping arrangement for the yoke accommodates standard hardware-size bolts, prevents the use of longer (protruding) bolts, and expels readily the sheared nut so a new one can be installed. Overall ball-shear device is hub mounted on a tractor's power take-off (pto) shaft. The yoke is part of a driveline for transmitting rotational power to the input connection of a stationary implement. ■

## Mulch-Piercing Injector Plants Seed-Bearing Plugs

Pneumatic seed-metering devices and reciprocating plug-placement mechanisms are used in vegetable planters developed by Renaldo's Sales and Service Inc., North Collins, NY (716-337-3760). Designed for fresh-market production areas, the bed-straddling machines possess several distinctive design features:

- **Seed Singulator**—Vegetable seeds flow against an inclined seed pick-up plate. Located inside a metering chamber next to a pressurized seed canister, the rotating plate aligns seed-filled cells with a pressurized port for discharge through a pneumatic hose.

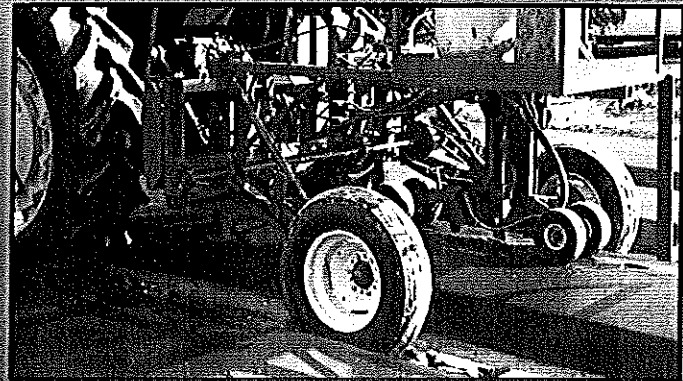
- **Fluidized Material**—The particulate material often combined with seed in a plug-like module is carried in a separate hopper. A measured amount of this material goes into a high-pressure line, which fluidizes seed/mix material enroute to a cup-like chamber.

- **Injector Mechanism**—Both seed and material are delivered to a plug-forming chamber at the lower portion of a reciprocating injector. This jaw-tipped apparatus punches down through the plastic, allows the hinged jaws to open, and then retracts upward.

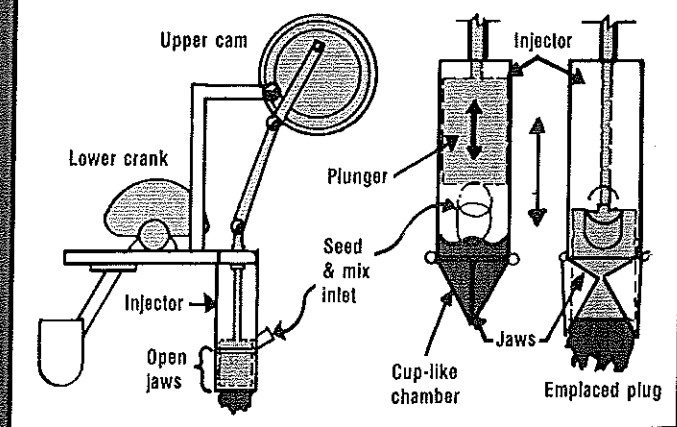
- **Plunger Device**—Inside the hollow injector is a plunger that pushes against the metered mixture so as to force open the jaws and expel the seed-mix plug. This fully extended plunger momentarily keeps pressing a plug into the soil after injector withdrawal.

- **Gauge Wheels**—Fore and aft pivot links are equipped with dual gauge wheels that roll along a bed's plastic covering, support the injector and feeder mechanism, and function within an adjustable floating system that regulates overall down pressure.

Raised seedbeds encased with plastic sheathing accommodate a second-step planting of plain cucumber seeds into depleted tomato beds (far right). All other photos show the Renaldo-developed machine injecting into new beds a punch-and-place series of plugs containing pepper seed, mix material, and fertilizer. ■



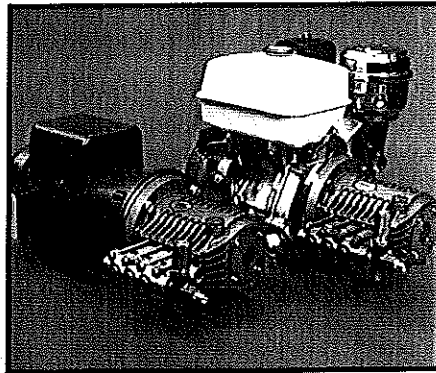
### Eccentric Drives Guide Plug Motions



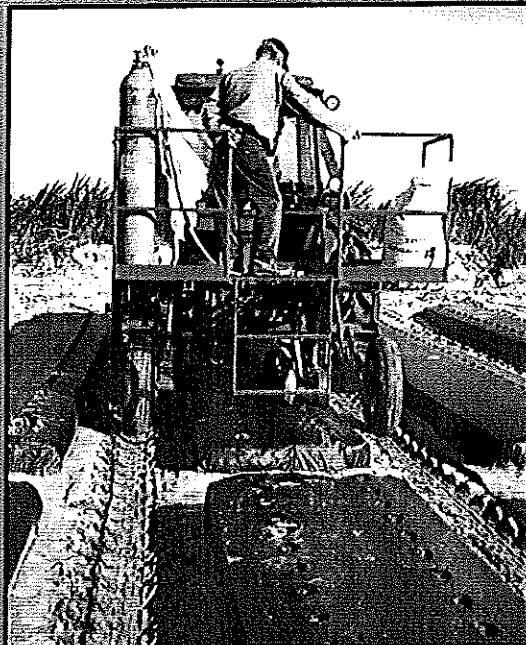
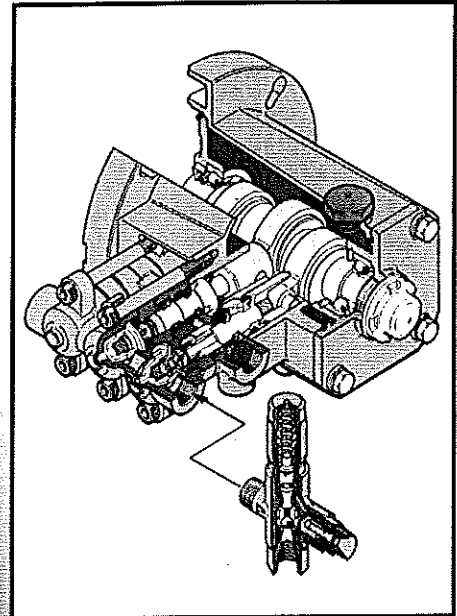


## Tough Ceramic Parts Pump Harsh Cleaners

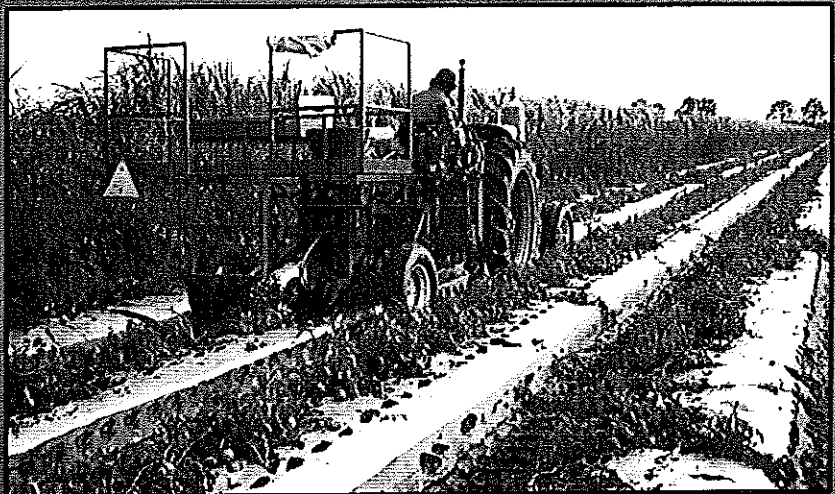
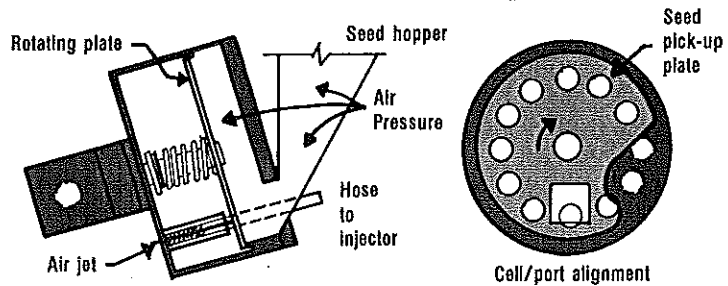
Solid ceramic plungers and spring-loaded inlet valves are combined in portable triplex pumps for high-pressure cleaning and sanitizing applications. Direct driven by electric motors (left) or small gasoline engines (right), the compact and lightweight pump packages eliminate conventional driveline components such as gearboxes, chains, or belts. The line-expanding "4SF" series of models weigh only 22 lb, operate at 1,725 and 3,200 rpm in respective electric and gas versions, develop up to 2,500 psi, and deliver outputs of 4.5 gpm, report designers for Cat Pumps Corp., Minneapolis, MN (612-780-5440). The firm has received a total of six patents for such distinctive features as a fluid motion-control provisions that improve suction at high speeds, minimize internal cavitation, extend seal life, and lower both energy and water



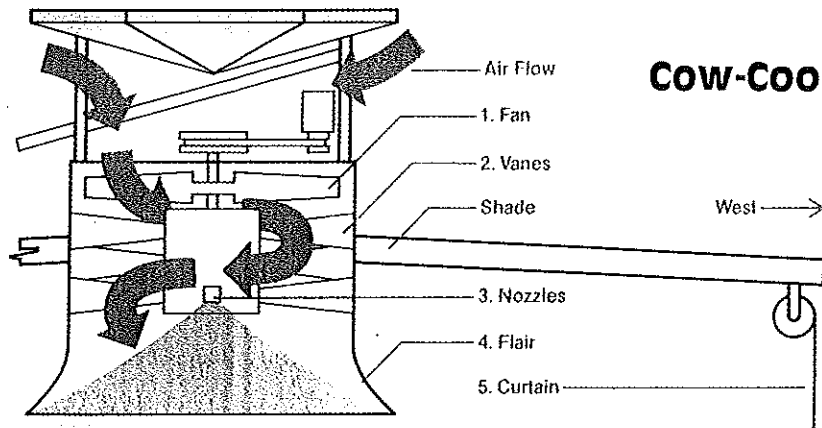
consumption. Each Super Flow pump also has a hollow shaft, regulating unloader, and chemical-resisting ceramic plungers. The six-model line of high-performance pumps is said to complement the firm's "2SF" units rated for 2 to 3-gpm, 1,200 psi, and 3,600 rpm. The increased speed ratings for these models permit rapid connection to a small gas engine or to an electric motor. ■



## How Air-Blown Plate Meters Hybrid Seed

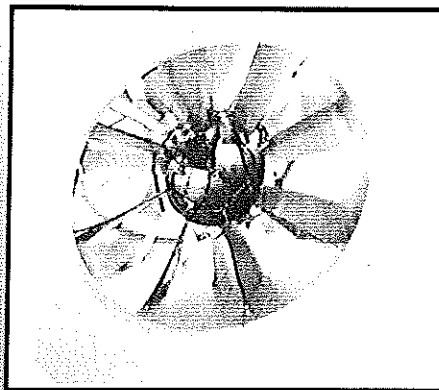
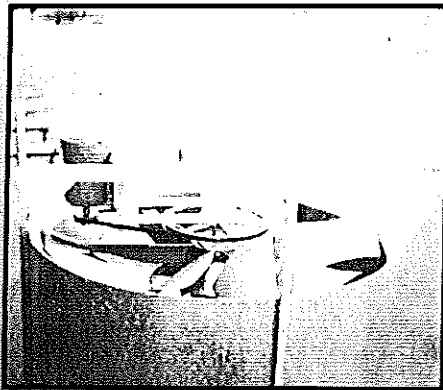






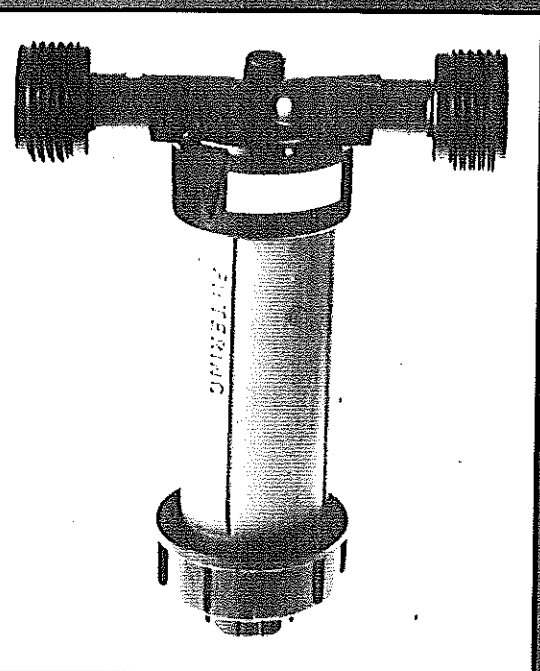
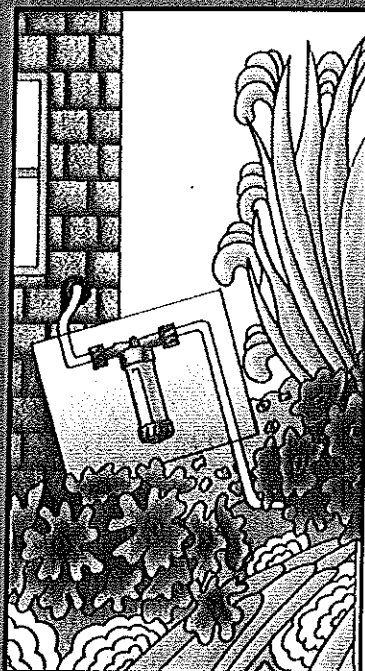
## Cow-Cooling Unit Lowers Heat Stress

Multiple nozzles inject atomized water into a turbulent air stream to cool cows in open shaded structures. The system is designed to alleviate heat stress, reduce mortality, and increase production among dairy cows in conditions from desert-like to hot humid climates. Injected water droplets evaporate and cool the air blown over the animals. Some droplets even reach the cows' bodies to provide additional evaporative cooling as air moves over the moist hide. Maximum cooling is achieved by matching the injected water volumes and droplet sizes with the ambient air temperature, relative humidity, and the herd's cooling requirements. This is done by installing five nozzle sets of different sizes in each cooler so that water volume and droplet size can be controlled by selecting any nozzle set— singly or in combination— with any or all other sets. A microprocessor-based controller measures wet and dry bulb temperatures, determines which nozzle set or sets to use and turns on selected valves to give the desired air-water mixture. Kool Korp., Mesa, AZ (602-892-6041).



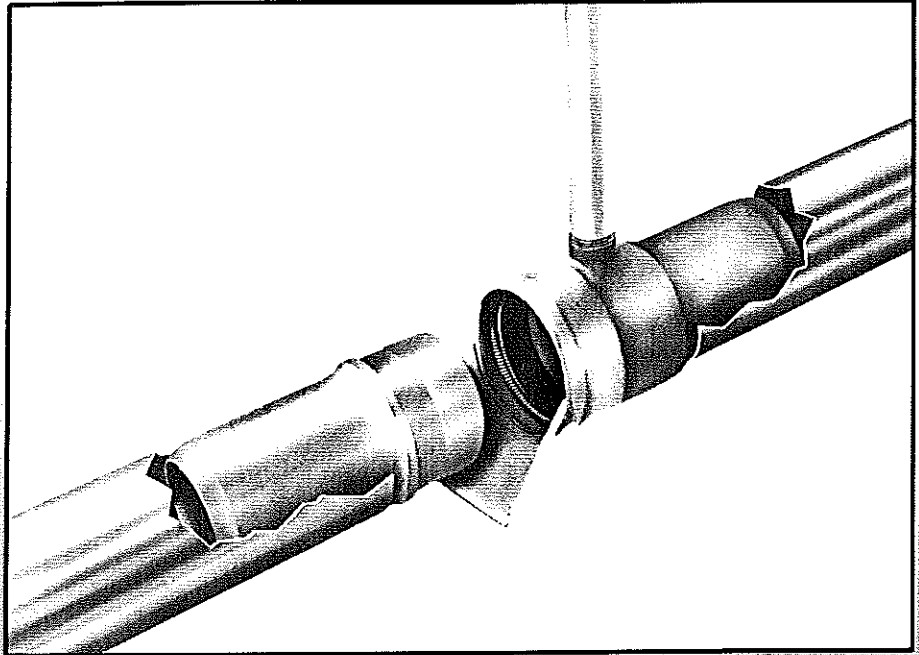
## Tri-Mode Filter Gives Uniform Irrigation

Three-function filter removes solid particles from low-volume irrigation lines to protect drippers, emitters and small sprinkler orifices from plugging. The three major components/functions include a 100 mesh filter, back-flush capability, and built-in shut-off valve. Accumulated particles are flushed from the filter by rotating the filter body one-third turn in relation to the cap. This arrangement directs water flow back through the filter to clear particles through a port in the top of the filter housing. Another one-third turn of the filter body shuts off water flow. Incorporating three functions in a single filter body saves user time, extends system life, and ensures uniform irrigation. Standard 1/2-in. fittings simplify filter installation; adapters are provided for other hose or pipe sizes. Recommended flow rate is 2 gpm. Amiad USA, Inc., Van Nuys, CA (818-781-4055).



## Water Pressure Locks Slip-In Fittings

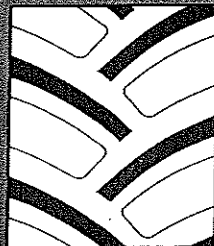
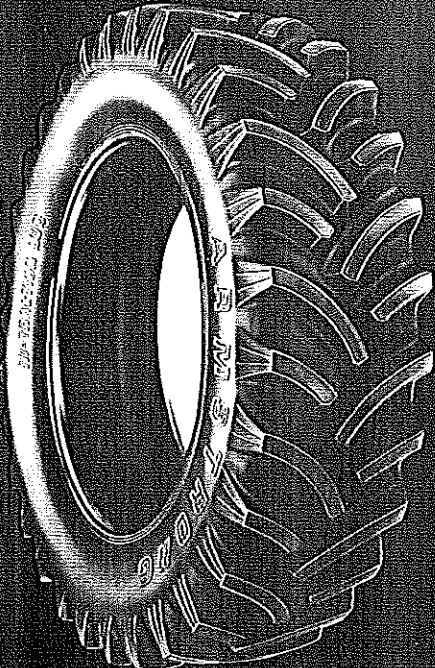
Push-together configuration for the tube ends and couplings of 3-in. diam aluminum pipe permits rapid assembly and disassembly of portable irrigation installations. The new type of fitting can be pressed into irrigation tubing without conventional rolling tools or requiring the hook-and-latch or clamp-type devices often used on portable pipe. When water flows through the assembled pipe, internal components of the female end constrict around a lip on the male fitting to form a tight seal relative to increasing water pressure. The higher the pressure, the tighter the seal. Conversely, shutting off the water relaxes the pressure-activated seal and "lock," enabling the couplings and fittings to be pulled apart without special tools, reports McDowell Mfg. Co., Div. of Alco Ind., Inc., DuBois, PA (814-371-6550). ■



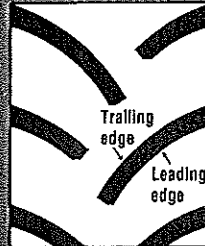
## Altered Lug Profiles Damp Tire Vibration

Equi-angular tapers for lug walls and curved bi-length tread bars are key features of drive-wheel tires built to accommodate an increased use of agricultural tractors on hard-surface roads and stepped up demands for smoother

riding vehicles. Designed to minimize vibration without compromising tractive effort, the new bias-ply Hi Traction Lug R-1 tires from Armstrong Tire Co., New Haven, CT (203-784-2239) have curved long and short lugs that are spaced closer together than the lugs of earlier tire models. The closer lug spacing means more lugs are in contact with the ground or road surface at all times, thereby reducing vertical and lateral tractor vibrations in the field and especially on paved surfaces. Curved lug bars serve the dual function of providing good forward traction as well as resistance to sidehill slip. Overall traction is improved slightly in Hi Traction Lugs by alternating the long and short tread bars, making the lug wall tapers almost equal for leading and trailing edges, and placing more lugs around the circumference of each tire. ■

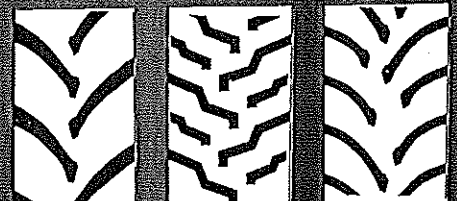
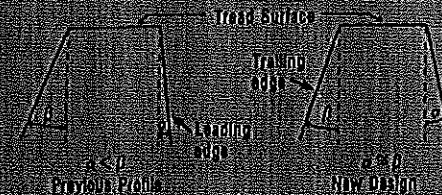


Conventional Hi-Traction Lug



New Hi-Traction Lug with Long & Short Bars

### How the Lug Wall Tapers Compare



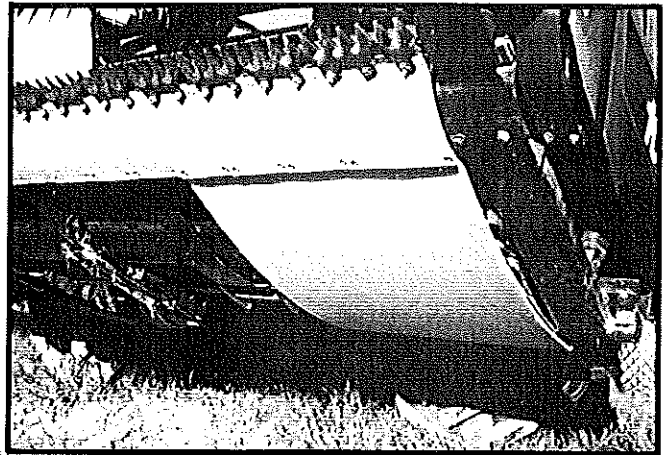
Conventional R-1 Tread Design    Combination of Long & Short Tread Bars    Long, Medium & Short Bar Lengths

### Other Types of Tread Designs

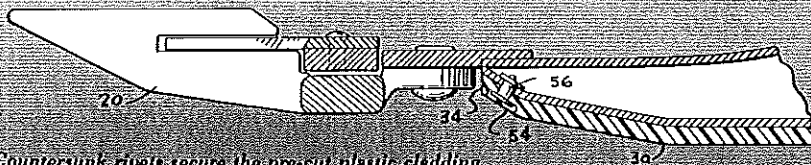
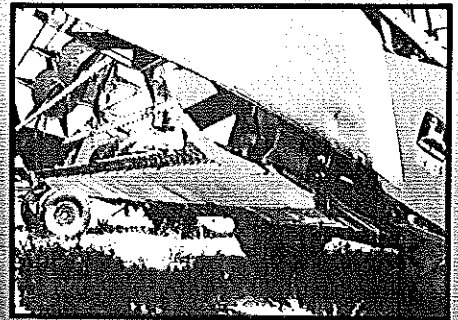


## Plastic-Clad Grain Header Parts Lower Cutterbar Losses

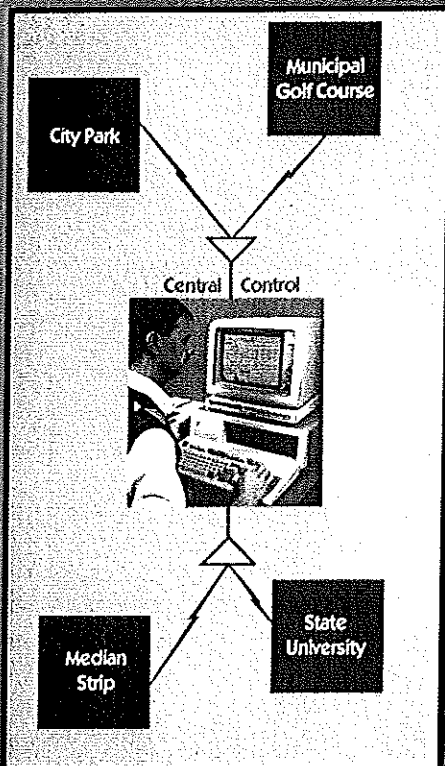
Grain platforms for combine harvesters will operate at a more uniform cutting height when the skid shoes and wear plate are clad with a soil-shedding layer of ultra-high molecular weight polyethylene (UHMW-PE), states an early 1988 patent awarded to T. Dean Rabitsch of Poly Tech Industries Inc., Monticello, GA (404-468-2801). According to cited claims, the soil-shedding plastic layer enables header shoes to glide over the surface, following ground contours and keeping the cutterbar at the proper height. This capability is particularly desirable when harvesting low-lying crops. The plastic-clad skid shoes thus reduce two types of potential build-up problems. For headers equipped with automatic height controls, soil adhering to unclad shoes can cause a unit to rise and miss several inches of crop. Similar build-ups beneath other headers can push soil ahead of the skid shoes, developing a mass that spills into the cutterbar. The sheet-applied UHMW-PE panels overcome these problems by conforming to part contours, offering low coefficients of friction, and providing resistance to abrasion, impact, and corrosion in harsh agricultural conditions. ■



Soybean-missing deviations in header height are minimized through use of plastic sheets.



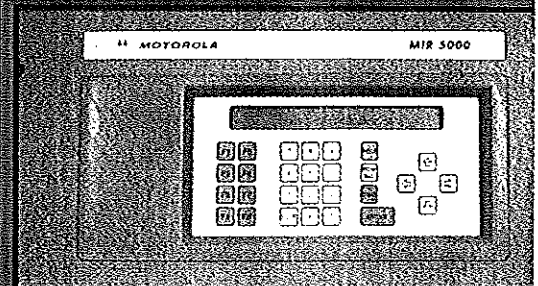
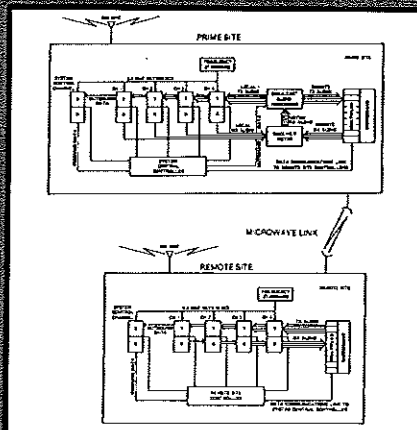
Countersunk rivets secure the pre-cut plastic cladding.



## Radio Links Extend Controller's Reach

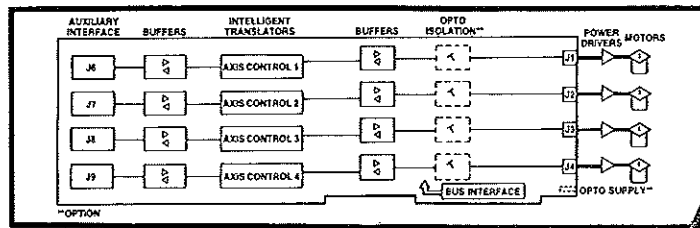
Far-reaching communication links help an irrigation system's central computer to keep tabs on multiple control functions within several distant sites. The wide-area coverage—city-wide for turf irrigation and county-wide for agricultural operations—is attained with a data telemetry adaptation of an 800-MHz trunked radio system. A microprocessor-based central controller

within the trunked system orchestrates all channel assignments when using RF frequencies to collect data, report alarms, and program operations. This capability represents an important addition to the MIR 5000 System that, in turn, employs an IBM PC-compatible computer for monitoring and controlling up to 6,000 field units. In most large installations, these units are connected to "smart" remote satellites equipped with 6800 Series microprocessors for multistep control of eight irrigation functions. Control Products, Motorola Inc., Riverside, GA (770) 81-7600. ■

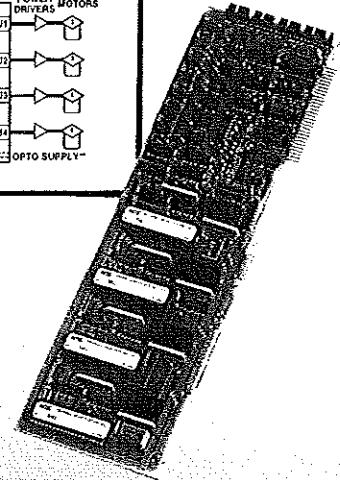


## PC Bus Card Issues Step Motor Signals

Complex motions of stepper motors are controlled along one to four independent axes with one bus-size card and a personal computer (PC). Featuring an on-board proprietary chip, the 13.2-in. long by 4.1-in. wide motor-control card generates the following signals—dual-speed jog inputs, limits (2) and home inputs, moving and trip output, two input ports, and three output ports—to power drivers for motors oriented along each axis. These capabilities are claimed to provide low-cost control with an IBM PC/XT/AT (or compatible) personal computer, squeeze all bus-required elements into one card slot, and simplify the



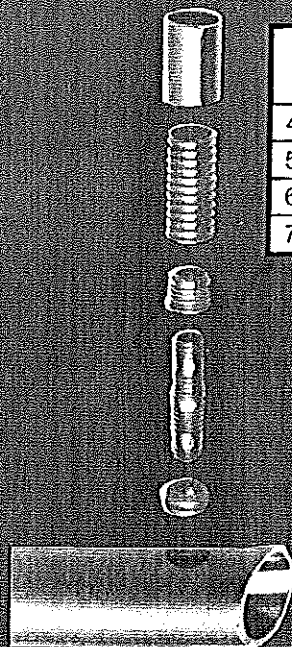
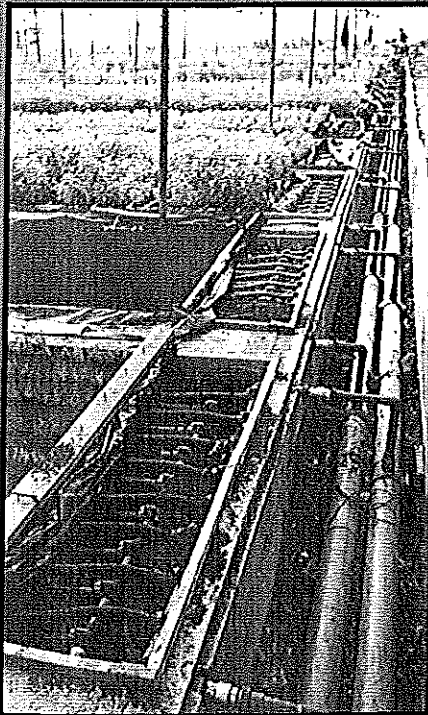
integration of overall systems. Precise electronic control of complex stepper-motor motions is reportedly needed in today's food processing operations, packaging automation machinery, and agricultural robotics. Programmable for step rates in excess of 14,000 sps, the PCMC controller for high speed indexing is a development of Advanced Micro Systems Inc., Hudson, NH (603-882-1447).



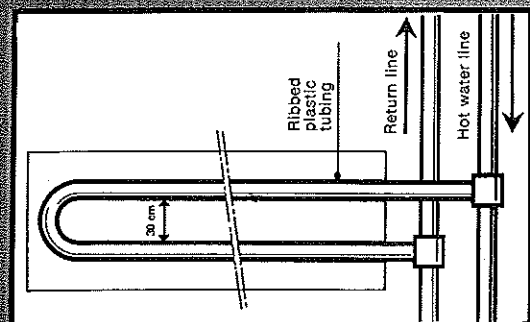
## Heat-Diffusing Tubes Warm Greenhouse Plants

Thin-wall corrugated tubing molded from polypropylene transfers to greenhouse vegetation the thermal energy released by an internal flow of hot water. A recommended water temperature of 50°C (122°F) is said to release 11.7 BTU/R<sup>2</sup> for heating tray areas, root zones, or above-ground foliage. Developed in Europe and the recipient of two patents, Agrotherm ribbed tubing is claimed to have twice as much surface area as smooth-bore tubing

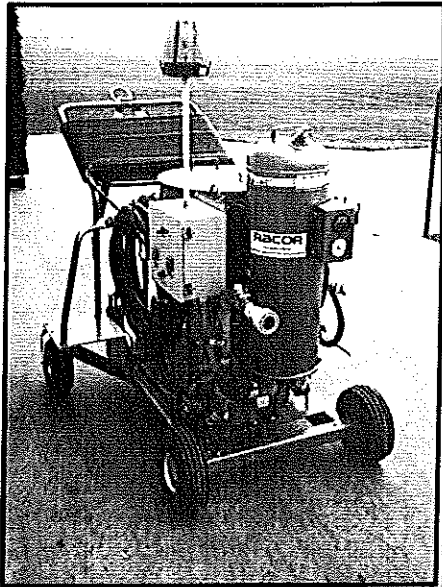
and to provide a heat-exchange capacity equivalent to that for metal. This 0.04-in. thick tubing is fabricated in 650 and 1,625-ft lengths with provisions for grommet-and-nipple (exploded view below) and threaded-adaptor connections to plastic or metal pipe. According to Drossbach Agro-Drip Inc., Los Angeles, CA (213-254-1265), the ribbed heat-transfer tubing is more efficient when placed on (rather than buried within) the soil.



Water Temperature	Normal Working Pressure in P.S.I.	Maximum Pressure in P.S.I.	Bursting Pressure in P.S.I.	Heating Power in B.T.U./sq. ft.
40°C/104°F	7 to 22	52	118	7.3
50°C/122°F	7 to 22	44	110	11.7
60°C/140°F	7 to 22	37	103	16.5
70°C/158°F	7 to 22	29	88	21.2





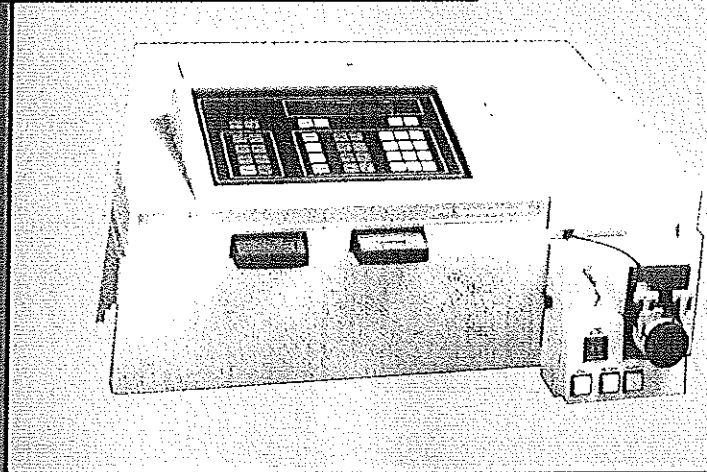
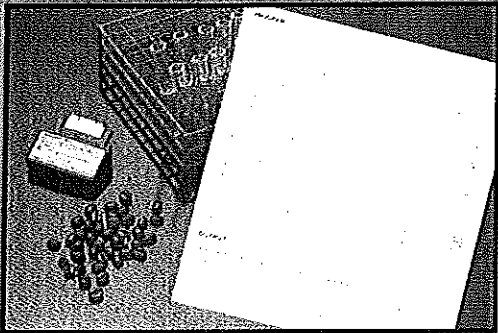


## Rig Converts Waste Oil Into Additive for Diesel Fuel

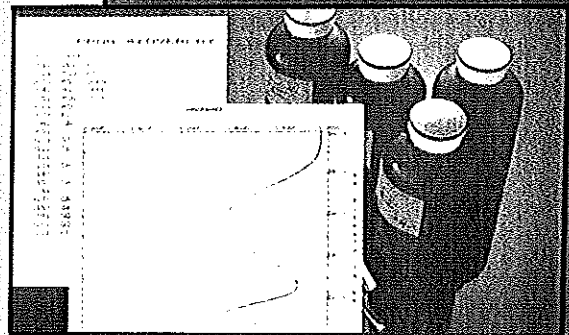
**M**obile blending unit receives spent crankcase oil from diesel-powered vehicles, reclaims the lubricant, and uses it—at rates up to 1-in-20 parts (or 5%)—to fortify “fresh” diesel fuel held in a storage tank. Fuel blended with oil has a higher Btu content and greater lubricity, and does not experience any change in flash point or cetane rating nor does it cause an increase in engine wear, smoke, or emissions, says the Racor Div. of Parker Hannifin Corp., Modesto, CA (209-521-7860). The used oil is drawn from a drain pan or other container, then blended with fuel pumped

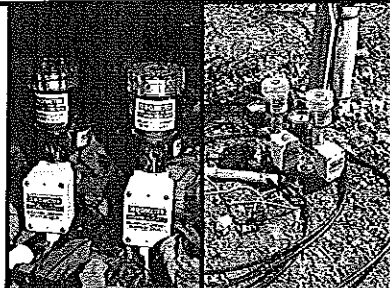
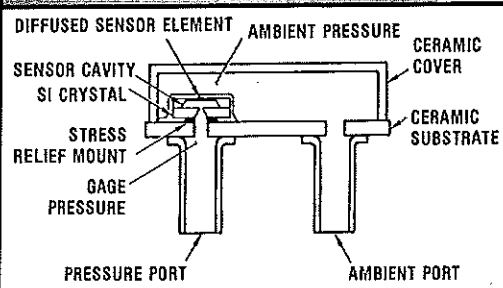
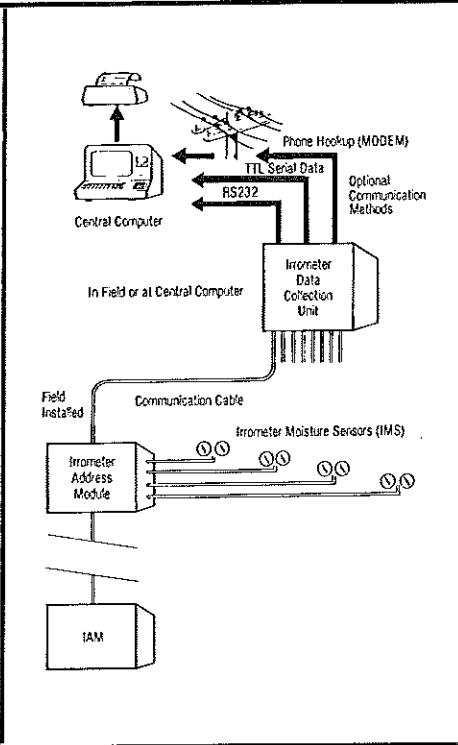
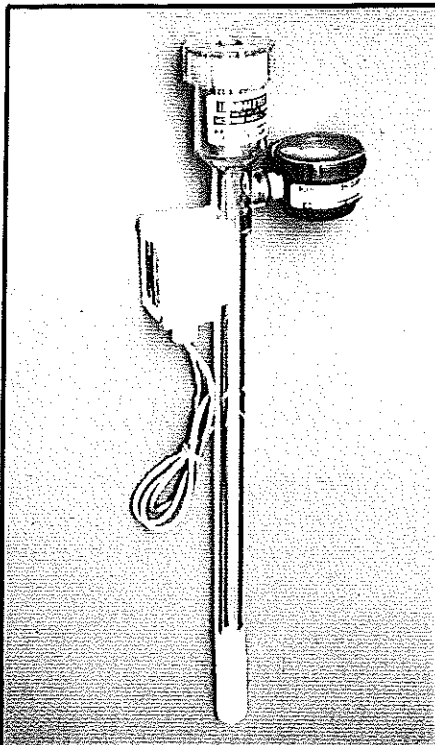
through a 25-ft hose from the bottom of a fuel storage tank. This mixture is filtered and cycled through a three-stage fuel filter/separator to remove water, dirt, rust, metal particles, sludge and algae from both the oil and stored fuel. The clean, blended fuel is then returned to the storage tank or to a vehicle’s fuel tanks through another 25-ft hose. Fewer vehicle fuel filter element changes and longer pump/injector lives are claimed because the filtration/ separation process cleans the fuel before it reaches the vehicle’s tank. The mobile blender cart also can be used in a recycle mode. ■

## Software Link Aids Spectrophotometric Food and Water Studies



**V**ersatile software package (Data Leader) couples a moderate-cost spectrophotometer (DU-65 UV/VIS) with an IBM personal computer for analyzing spectral data from food and other agricultural materials. According to the Scientific Instrument Div. of Beckman Instruments Inc., Fullerton, CA (714-871-4848), the system permits both qualitative and quantitative analyses of the colors, vitamins, proteins, and other nutrient contents in food, basic protein structures and amino acid concentrations of substances, and contaminants, effluents, or other materials affecting water quality. All have distinctive absorption characteristics in the UV and/or visible portions of the light spectrum. Data may be presented on a CRT screen in tabular or spectral form, manipulated (such as adjustable perspectives for 3D viewing), and printed by a dot matrix printer/plotter. ■





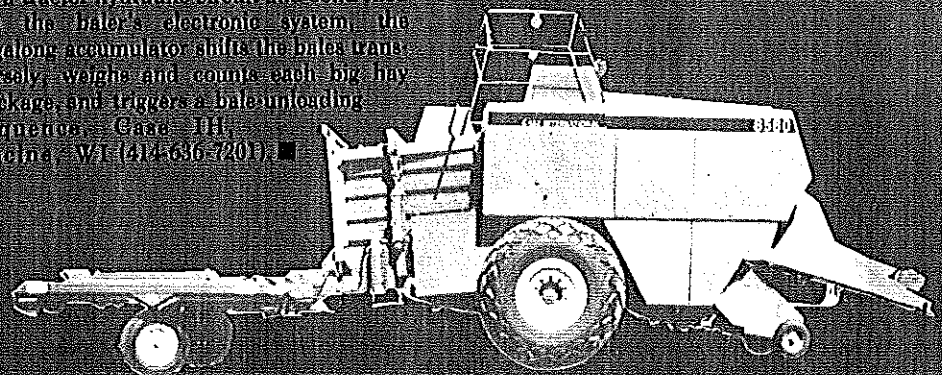
## Remote 'Stations' Track H<sub>2</sub>O Levels

Remote tensiometers are now fitted with pressure transducers and on-board electronic devices so irrigation managers can "call up" water-suction readings (tensiometric data) via their personal computers. Developed by Irrrometer Co. Inc., Riverside, CA (714-689-1701), the complete system consists of tensiometer/transducer sensors; address modules that collect data from up to eight sensors; and a microprocessor data-collection unit for polling the address modules/sensors and reporting the data. Analog/digital data for actual soil/water-suction readings from any or all sensors are transmitted among system components by cable or infrared telemetry. Infrared links can also be used to monitor irrigation reservoir levels as well as pumping plant operations. According to Irrrometer's William R. Pogue, data accuracy is enhanced by temperature compensated transducers having an accuracy of 1.0% over a range of -40° to +115°. The system can also detect the presence of air bubbles or voids in any device, thus avoiding faulty data caused by entrapped air or the need to constantly check field instruments. Package sealing to protect components from the environment further helps prevent data upsets due to pressure buildups inside the remote moisture sensing "stations."

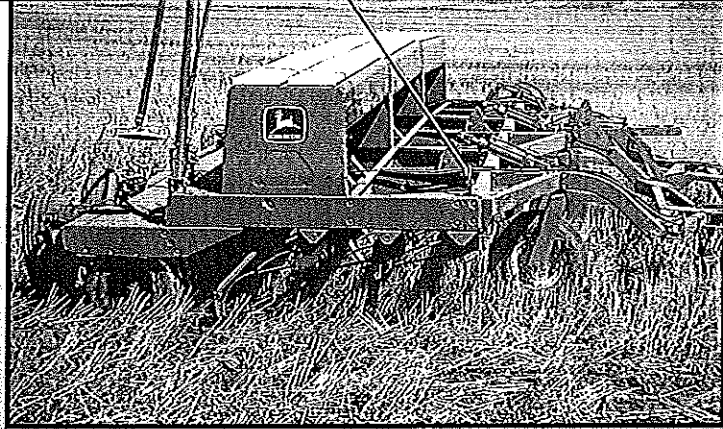
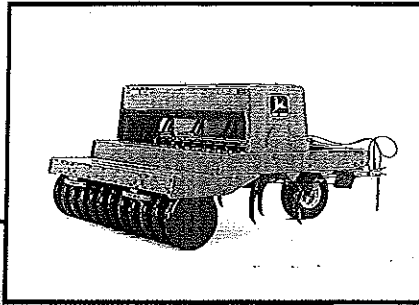
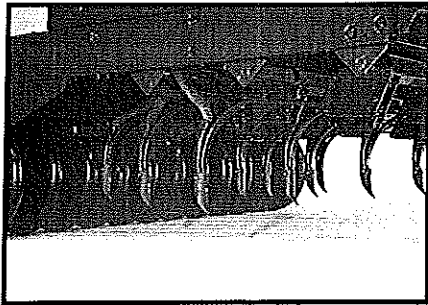
## Big Baler Melds 27 Novel Features

Twenty-seven patents cover the major novel features built into Case IH's large rectangular baler (Model 8580) and companion cart (Model 8581), which accommodate 1 to 3 trunk bed-sized bales in their length and weigh up to 108 in. and 2,000 lb. respectively. Large-diameter "flakes" of hay are preformed by packer forks in the baler's charge chamber. The sensor-monitored flakes are then moved by stuffer fingers into a 46.5 by 50 in. bale chamber. Material density is further controlled with microprocessor-based electronics that measure plunger forces and adjust the fluid pressure to hydraulic cylinders exerting compressive force along

the bale chamber's top and sides. Powered by a tractor hydraulic circuit and controlled via the baler's electronic system, the tagalong accumulator shifts the bales transversely, weighs and counts each big hay package, and triggers a bale-unloading sequence. Case IH, Racine, WI (414-636-7401) ■





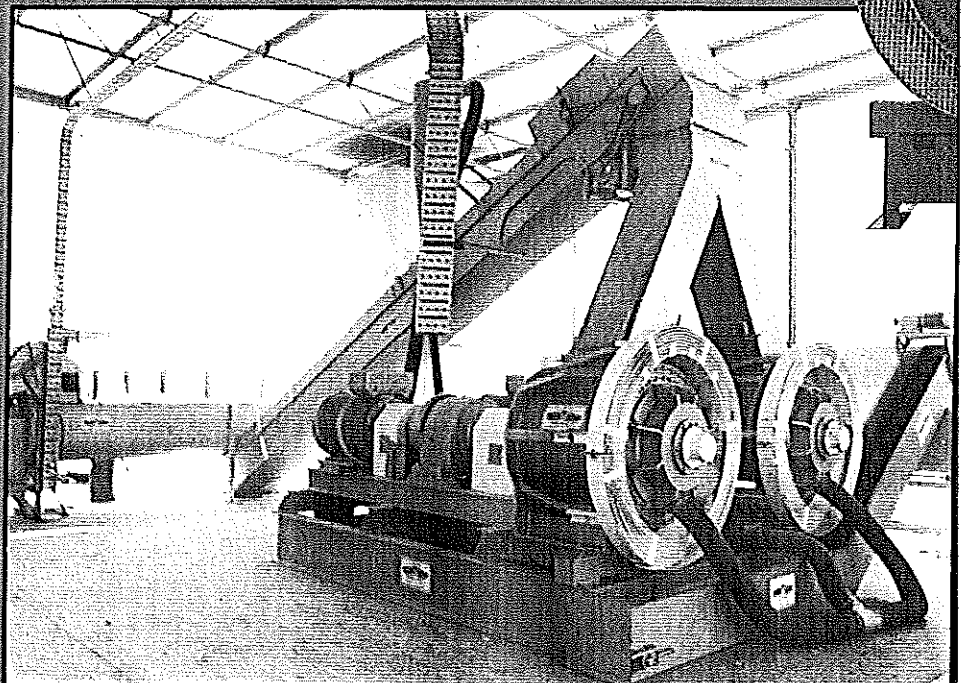


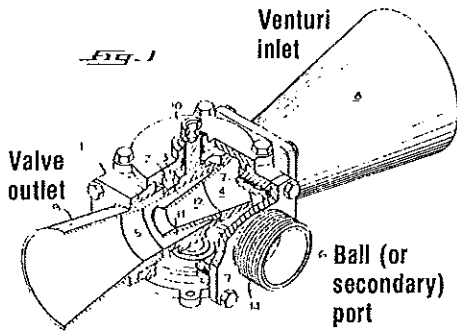
## Grain Drill Fields Staggered Openers

**T**rash-clearing grain drill with adjustable hoe-type openers is built for seeding a 10-ft width in tough stubble or heavy residue. At least 20 in. of fore, aft, and lateral clearance among openers is obtained by mounting the drill's 17, 12, 10 or 9 openers along three separate ranks. This arrangement provides a phased or staggered array of openers at row spacings of 7, 10, 12 and 13.3 in. while allowing all ranks to be tied together through a common linkage. Only one hydraulic cylinder applies machine-wide down pressure and thus controls the seed-placement depth for all openers. A 29-in. vertical clearance is also provided to facilitate work in minimum-till conditions with 1.75-in. wide rigid (or optional spring-loaded) hoe openers and 26-in. diam press wheels. Numerous hopper shovel, and wheel options help adapt 9400 Series machines for grain, fertilizer, and grass seed. John Deere Des Moines Works, Des Moines, IA (515-289-3058). ■

## Hay-Extruding Machines Boast Interchangeable Dies

**C**ircular machine head develops huge compressive forces when extruding small packets of material from alfalfa, forage, sawdust, composite materials, and other bindable commodities. Interchangeable dies and die rings—one of four patented features—enable the machine to produce packets ranging from 0.75-in. diam pellets to 1.25 in.<sup>2</sup> cubes. Other novel elements of the M166 cubing machine are a bell-crank support ring with dust retainer, an external greasing capability for the presswheel, and a fabricated steel end cap with only four inspection doors. The machine's in-line drive system consists of a 200-hp electric motor, friction-disc clutch, planetary gear reducer, flexible couplings, 4.9-in. diam drive shaft, and 4-1/2/16-in. diam external bearings. These components enable the 6-ton, 14-ft long machine to extrude 6 to 10 tons/h of cubes. Developed by Montano Mfg. Inc. of Merced, CA (209-383-1443) the M166 cubing machine can be incorporated within a plantwide system for taking in raw materials and shipping out the cubed commodities. ■

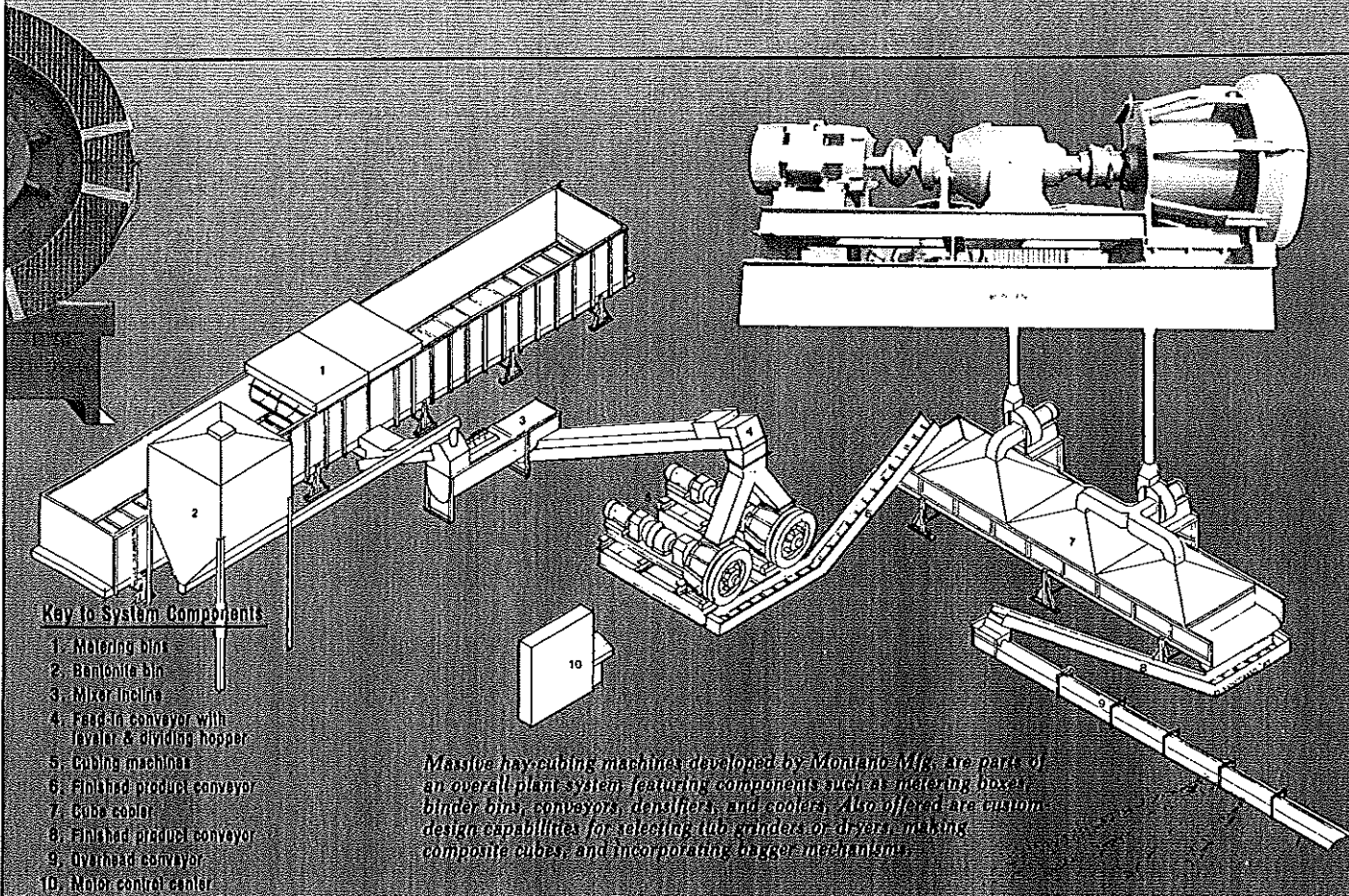
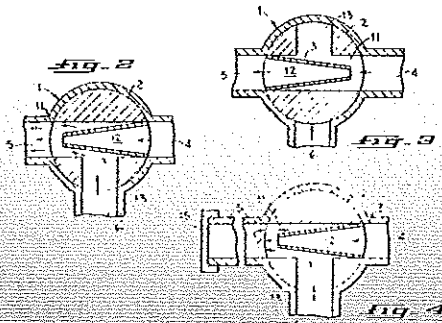




## Hybrid Valve Purges Aerial Spray Tanks

A three-port assembly is created by combining into one unit the functional elements of ball and venturi types of valves. The integrated package eliminates hardware elements, simplifies plumbing arrangements, and enhances valve capabilities. According to valve designer George S. Sanders, the unit's most promising application is for emptying out the chemical tanks, fluid lines, and spray booms aboard agricultural aircraft. The fluid-inducting valve reportedly can purge all chemicals over an aerial job site rather than cause a plane to return to base with residual spray materials. Such wastes must be flushed out and stored for subsequent disposal. When devising the new valve, Sanders first aligned two cone-shaped elements within the overall

structure of a two-way ball valve. This venturi-forming arrangement provides inlet and outlet ports, restricts the flow of a primary fluid, and creates at mid-valve a partial vacuum. Ported to the central area is a transverse or right-angle passage that allows a secondary fluid to join, mix, and escape with the primary fluid (Fig. 2). The venturi throat and secondary inlet are housed within a ball-like device, which can be rotated to seal off the transverse port (Fig. 3). The secondary passage leads to crop-spraying booms, lines, and tanks. Slipstream air is the valve's primary venturi-directed fluid aboard an ag plane. This ram-fed air thus induces the tank-purging flow of chemical materials, reports Sanders, Agrinautics, Las Vegas, NV (702-736-3794). ■



### Key to System Components

1. Metering bin
2. Blender bin
3. Mixer incline
4. Feeder conveyor with leveler & dividing hopper
5. Cubing machines
6. Finished product conveyor
7. Cube trailer
8. Finished product conveyor
9. Overhead conveyor
10. Motor control center

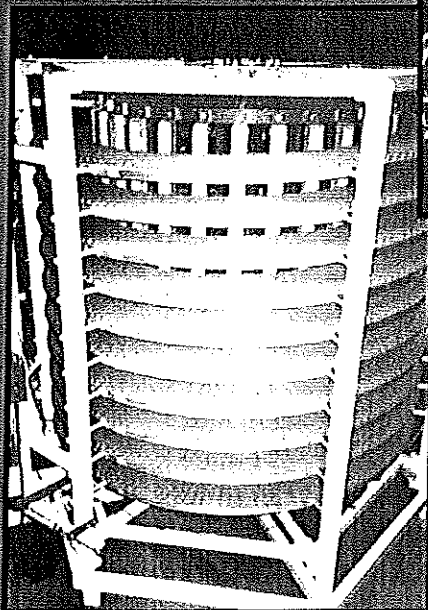
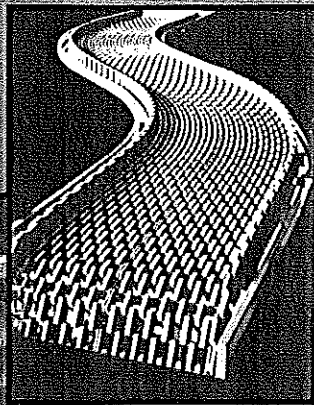
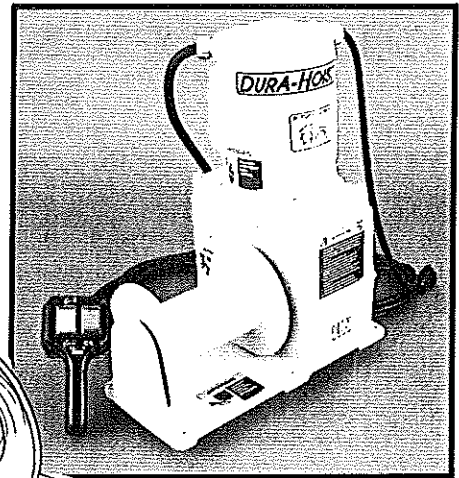
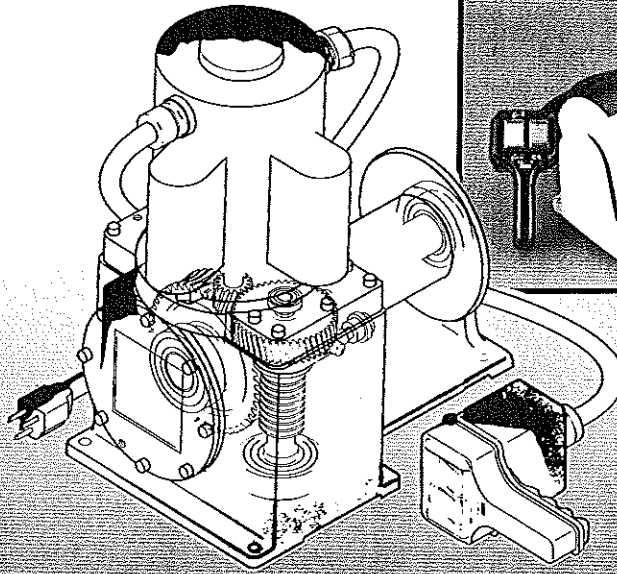
Massive hay-cubing machines developed by Montana Mfg. are part of an overall plant system featuring components such as metering boxes, blender bins, conveyors, densifiers, and coolers. Also offered are custom design capabilities for selecting tub banders or dryers, making composite cubes, and incorporating bagger mechanisms.



## Modular Drive Offers Lift/Pull Option

One major factory change—a brake for lifting objects versus a clutch for pulling loads—adapts a basic hoist/winch design for two main types of field applications. The 65-lb modular assembly is thus capable of vertical lifting and/or horizontal pulling operations for payloads up to 2,000 lb. An overall assembly can be mounted along horizontal (floor), vertical (wall), or upside down (ceiling) orientations. A sling-and-hook provision is used for attaching a payload to one end of a 50-ft long wire rope. The cable's other end wraps around a 3-in. diam drum. This drum winds up or pays out the wire rope according to drive motions imparted by a helical/worm-gear type of speed reducer. The double-reduction gearbox is powered by a 1.2-hp electric motor that, in turn, is connected to 120-V supply lines. Also connected to the motor via 10-ft of cord is a pendant-type control featuring two momentary contact switches. One button changes the direction of travel; the other button turns the 477 Series hoist/winch motor on and off. According to

Thern Inc., Winona, MN (507-454-2996), the modular drive features a one-piece cast aluminum housing, water-tight construction, and white epoxy coating. ■



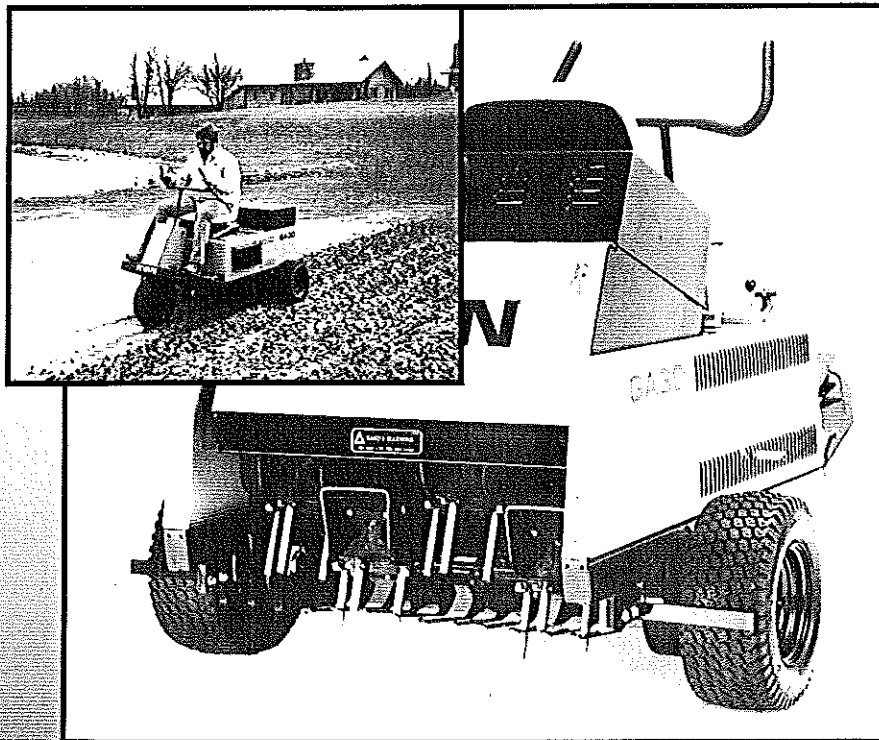
## Carousel Takes Food Through Processes

Multi-tier spiral conveyor attests to the tight-turning capabilities now being achieved with plastic belts. Developed primarily for food-processing applications, the circular array is said to represent an extensive design modification of earlier smooth-radius belts made from engineered

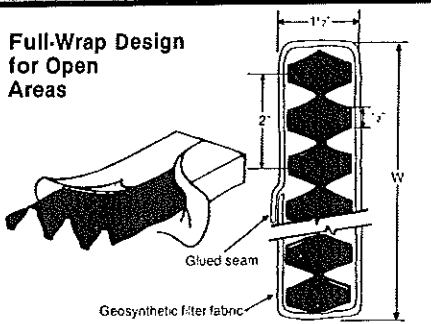
plastic components (inset). The plastic food-toting carousels are intended for the cooling, freezing, proofing, elevating, holding, and handling applications that previously have rolled on wire, mesh, or steel belting. About one-sixth the weight of a comparable metal design, the plastic spiral belt provides up to 65% open area and it can be assembled from polymers for operating in temperatures from  $-70^{\circ}\text{F}$  (for freezing) to  $+350^{\circ}\text{F}$  (for sterilization and cooking). Belt system components are available in materials that meet FDA requirements for direct food contact and comply with USDA specifications for cleanliness in place. That is, the components resist chemicals, eliminate lubricants, and avoid contaminants. Interlocking belt elements also provide continuous material support without marring or damaging the delicate products or packages. Related mechanical aspects of belt application include low levels for friction, vibration, noise, wear, and power requirements. Developed by KVP Systems, Inc., Rancho Cordova, CA (916/635-5131), the space-conserving spiral belt is for use by food-processing firms. ■

## Turf Coring Machine Alters Hole Spacings

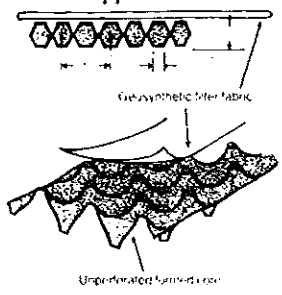
Variable core spacings and working speeds are featured in a riding turf aerator built to supplant walk-behind units. An 18-hp engine teams with a hydrostatic transmission to give the 1,200-lb machine an infinite number of travel speeds from 0 to 6 mph. Hydraulic devices and mechanical linkages also enable an operator to adjust the longitudinal core spacings from 1 to 5 in. during operation. These mechanisms control the reciprocating action of four chain-and-belt-driven rams—each fitted with three hollow tines located 2.5 in. apart. The reciprocating claw-like devices can thus make 11.5 to 57.6 holes/ft<sup>2</sup> as the tines punch into turf, remove sod plugs, and leave aeration holes across a 30-in. wide swath. Four sizes of tines (3/8, 1/2, 5/8 or 3/4-in. diam) are available for penetrating up to 3.75-in. deep. Developed by OMC Lincoln/Ryan, Lincoln, Nebraska (402-475-9581), the Model GA 30 can aerate from 5,625 to 28,125 ft<sup>2</sup>/h. ■



### Full-Wrap Design for Open Areas

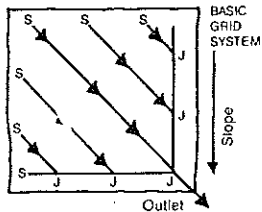


### Wall Applied Version

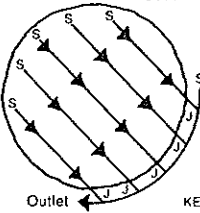
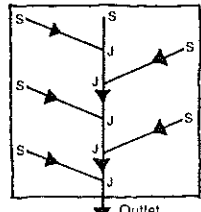


## Plastic Drain Strips Cut Site-Related Costs

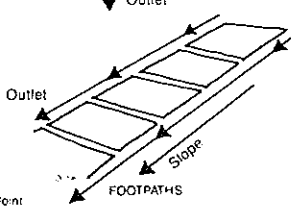
Waffle-shaped plastic strips are wrapped with geosynthetic fabric to establish drainage structures in open horticultural sites and along building walls. In addition to channeling water away from treated areas, the thin-section panels help cut installation costs by fitting into narrow slot-type trenches. This arrangement is claimed to minimize digging operations, reduce gravel fill materials, and alleviate potential surface clogs. The 1.6-in. thick strips for open-area drainage have a polyethylene core with 2-in. undulations and a laminated outer layer consisting of nonwoven polyester filter fabric. Water enters the structure via needle-punched perforations throughout the geosynthetic material. A porous fabric lines only one side of the 0.75-in. thick panels molded with core wavelengths of 1 in. These panels are installed along walls, foundations and buildings to relieve seepage. Seed/Spout Products Div., Warren's Turf Professionals, Sulam, CA (800)328-8873. ■



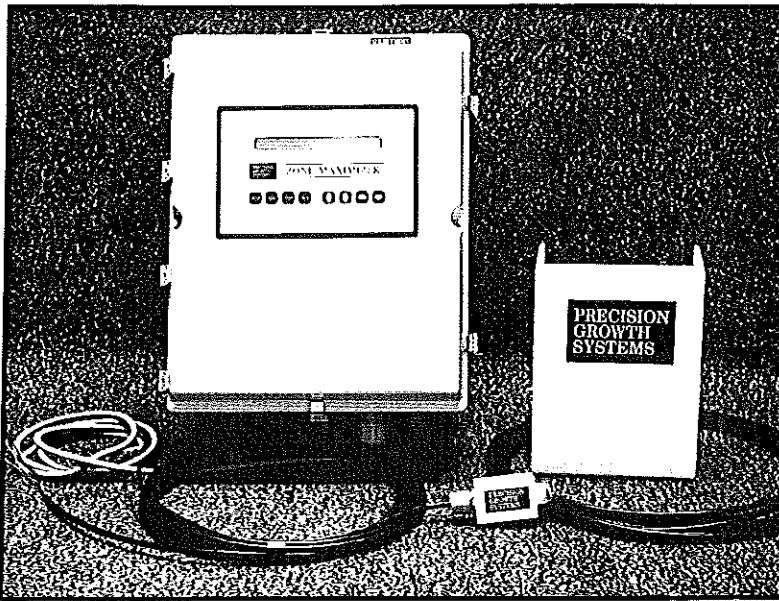
### HERRINGBONE SYSTEM



KEY S — Sealed End J — Joint





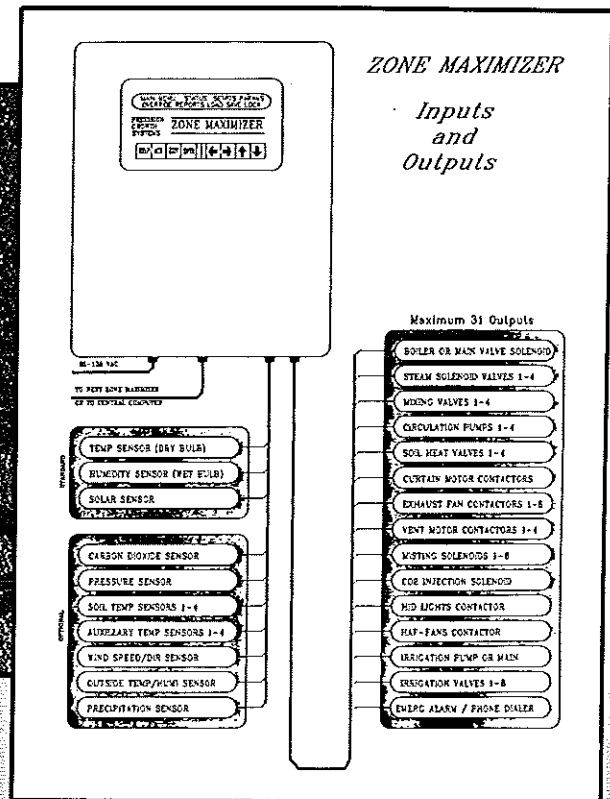


## Status-Tracking System Commands Growth-Inducing Equipment

Ten environmental factors and 15 equipment functions are the key input/output values for an integrated system configured to optimize growing conditions within greenhouses, mushroom

chambers, and poultry houses. Data from up to 16 condition-revealing sensors are fed to the clone of an IBM-AT computer, compared with set-point figures, and processed via software. The system responds by is-

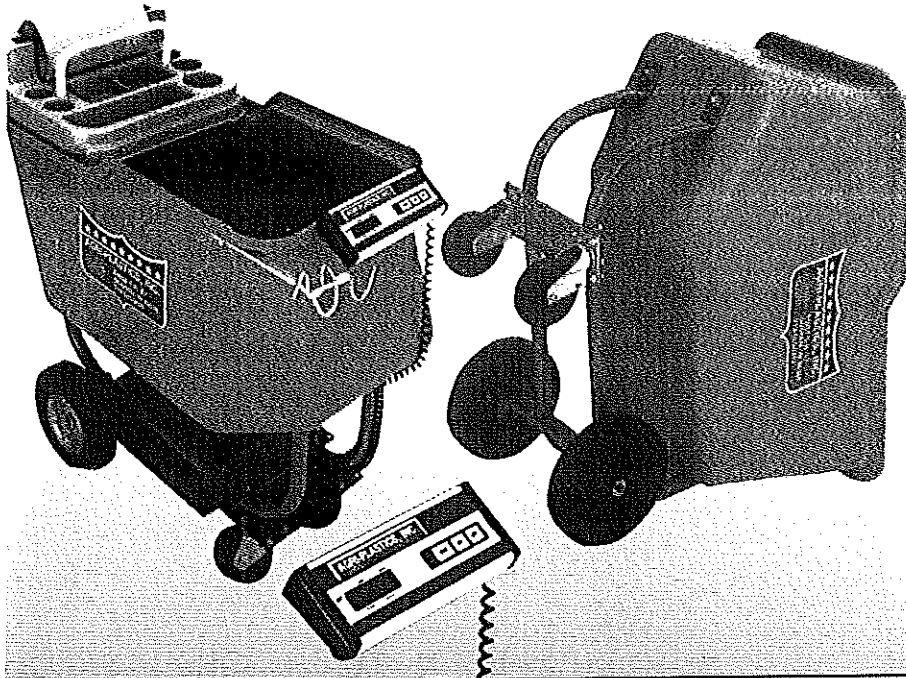
suing up to 31 relay-output signals within a network of actuators for equipment that controls the environmental conditions. Precision Growth Systems, Santa Clara, CA (408-727-6256).



## Heat-Sensitive Probe Checks Out Process Materials

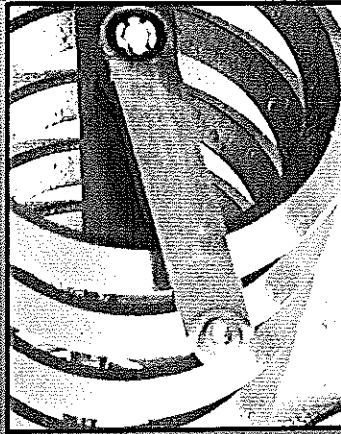
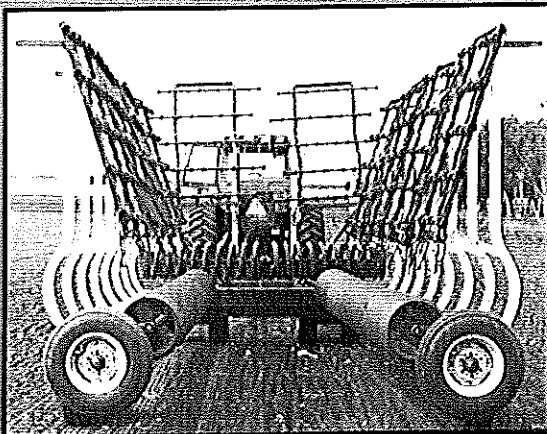


Thermocouple probe and digital instrument are combined in an integral design claimed to achieve lab-level sensitivity when measuring process temperature under rugged field conditions. Available in both °C and °F types with either surface or needle-type probes, the Atkins 300 series unit is rated for  $\pm 0.1\%$  of reading accuracy within  $\pm 0.7^\circ\text{C}$  over a full range of  $-70^\circ\text{C}$  through  $260^\circ\text{C}$ . The surface probe version gets a 99% final reading in 11 s on oiled metal surfaces, whereas needle probe models obtain 99% final readings within 5 s in liquids such as milk, juice, water, and chemicals. Many critical temperature measurements in process and production operations can also be made of pulp (fruit, vegetable, paper, or wood), food and milk products, soil, and equipment or machinery. Unit is powered by a 9V battery able to generate a strong signal from the Type J (iron-constantan) thermocouple and produce easily viewed 0.3-in.-high LCD digits within a back-lighted display. Both point and slope-type errors at  $0^\circ\text{C}$  and  $100^\circ\text{C}$  are eliminated when the probe and instrument are calibrated at the factory. This built-in accuracy is reportedly preserved with an O-ring seal, splash-proof case, protection against radio-frequency interference (and other electrical noise), and absence of exposed adjustment. Consequently, the calibration-grade thermometer priced under \$100/unit extends low-cost precision to a wide range of processes, materials, and operations. Rugged enough to stow in a toolbox, the 6.1-in.-long, 2.6-in.-wide, and 1-in.-high instrument can also fit into a shirt pocket. One-hand operation (inset) is achieved by aligning the probe into recessed channels along the instrument's side. Atkins Technical Inc., Gainesville, FL (904-376-5555).



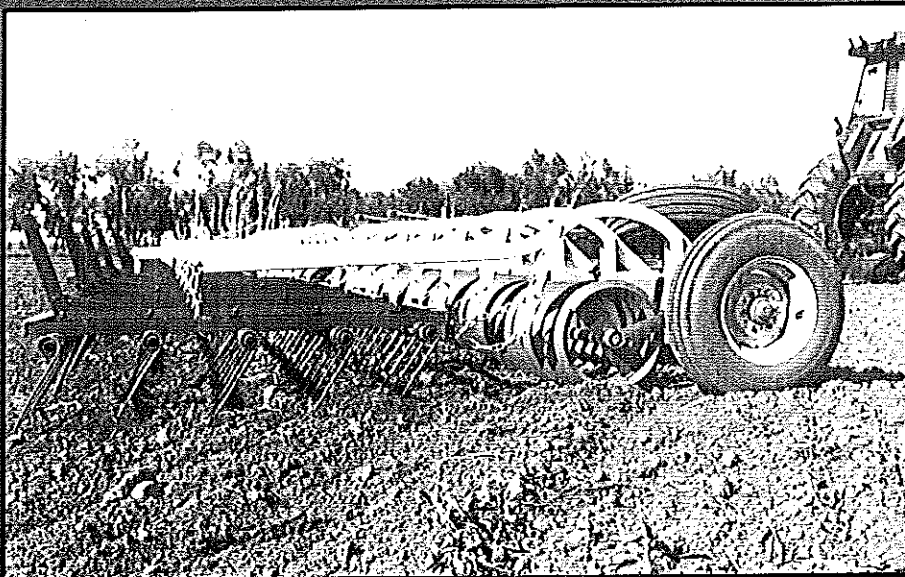
## Tough Plastic Tub Helps Tend Animals

Seamless 5.6 ft<sup>3</sup> tub is rotationally molded from high-density polyethylene to carry feed, veterinary, and other animal-tending supplies. Mounted on a tubular steel frame with 10-in.-diam rear and 6-in.-diam caster wheels, the 41-in. long by 19-in. wide Chore-Cart can haul, dump or weigh many types of cargo. A battery-operated electronic scale can give the weights for a full load of feed, an entire litter of pigs, and of each pig or each scoop of feed removed from the cart. Agri-Plastics Inc., Goshen, IN (219-533-0497). ■

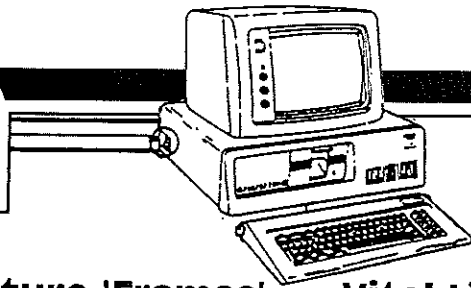


## Toolbar Tows & Tilts Soil-Finishing Tools

Helical-coil firming elements are mounted ahead of spring-loaded leveling tines along the three-section frame of a soil-finishing rig for seedbed preparation. Built in 10-ft increments for working widths of 30 to 70 ft, the towed cart-like frame is equipped with full-width soil-packing units formed into 18-in. diam coils from 1.5 in.<sup>2</sup> bar stock. An alternative size consists of 1.75 in.<sup>2</sup> bars rolled into 19.75-in. diam coils. Each 5.75-in. pitch coil-type packer unit is mounted on an axle shaft with tapered roller bearings, and attached to the toolbar frame by pivot-mounted trailing arms. Also hotted to the frame are numerous arched cantilever arms from which the 5-ft-wide harrow sections are suspended via multi-link chain. These soil-smoothing and trash-leveling sections are offered in four or five-bar configurations with either straight or bent tines. All mounting provisions enable the packer and harrow sections to adjust their orientations according to field obstructions and ground contours. In addition, the rig's three-section frame can be rotated 90 deg to an 11-ft height, then allowed to fold into a 46-ft width for transport. Hinged-wing articulation is aided through the use of structural steel tubing, hydraulic lift cylinders, and special transport tires. Packer, harrow, and packer/harrow modes are tunable. Morris Rod Wagon Co. Ltd., Yorkton, SK, Canada (306-783-8585). ■



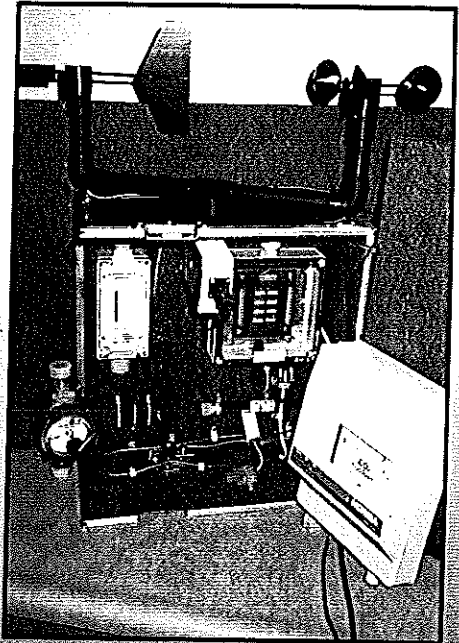




## Universal Structure 'Frames' Vital Life-Controlling Functions

A central management system relies on a personal computer for controlling environmental conditions and operating essential processes within agricultural structures. Embodied in the PMS 2000

System is a universal framework—compatible computer, basic architecture, modular hardware, and expandable software—allowing the system to be adapted for plant and animal production facilities that vary in type, size, number, and sophistication. The framework includes microprocessor-based data gathering panels, relay control units, motor control units, and many other devices. These are integrated so the system can monitor conditions, sound alarms, issue reports, generate graphs, and control functions according to basic operating parameters and programmed instructions. But an overall shell-like structure can also be customized for specific applications and/or changing situations. For example, relational logic, sensor types, and input modules can be modified according to different plant and animal requirements, and to embrace new production technologies. Systems of this type are now used in applications ranging from highly complex egg-laying facilities to very demanding mushroom-growing operations, report Joseph Baum and Alfred M. (Mo) Campbell, co-founders of Automated Environments Inc., Locke, NY (607-533-4214). They say future systems will help to maximize profits by incorporating critical plant/animal production factors with market analyses, optimizing algorithms and expert systems.



Input devices for 12 sensor types include a proprietary design for electronic ammonia detection (above). Each modular data-gathering panel (DGP) (see left) receives analog inputs, generates digital outputs, features a "watchdog" relay, and includes an expansion board. The PMS 2000 System handles up to 250 DGPs, which are connected to various relay and motor control units (below center).

