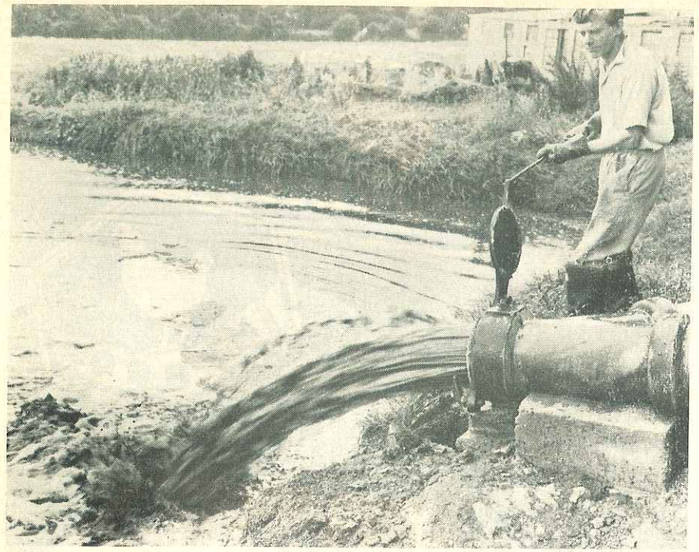


A LAGOON IS an area of shallow water close to the poultry house, into which manure is dumped for bacteria to digest. The lagoon needs only to be emptied of surplus sludge every 10 to 15 years. Manure mixed with water is here seen being piped into a lagoon at Kent, England.

SUMMARY: Last month, Anthony Phelps discussed methods of manure disposal open to egg producers who can utilize manure on their pastures or arable land. This month, Mr. Phelps discusses methods available to poultrymen who cannot dispose of manure on their own land. Such systems include manure lagoons, oxidation ditches, manure drying and methane gas production.

Second of two articles

The Problem of Cage Manure Disposal

• The problem of manure disposal becomes more acute when an egg producer either has no land, apart from the ground his poultry unit stands on, or a limited acreage which will absorb only a fraction of the manure output from his cage laying operation.

However, the problem certainly is not insoluble. There is a poultryman in South Africa, for example, who has found such a remunerative outlet for his hens' manure that it has become his primary source of income, and he looks upon the eggs as a by-product.

Everybody may not be as fortunate as this, but there are several different ways out of the predicament that are worthy of consideration. Some solutions merely require a little ingenuity, while others can turn out to be real money-makers.

Manure Lagoon. A method of disposal which has created a lot of interest in the U.S.A., is sometimes claimed to be the system which literally makes manure disappear. A lagoon is just a large area of shallow water into which the manure is dumped. The disappearing trick is performed by bacteria which digest the waste material and convert it into gases.

When a lagoon is working correctly, manurial breakdown is complete and it should only be necessary to remove a little surplus sludge every 10 to 15 years. In addition, the lagoon does not overflow, remains sweet smelling, and does not attract flies or mosquitoes.

Unfortunately, the environmental conditions needed by the bacteria to enable them to work efficiently are critical, and there are only a few areas of the world where the climate is helpful. As a general principle, bacterial activity is accelerated in warm weather and is slowed down as temperatures fall.

Lagoons will not be successful in countries which experience long, hard winters. Bacterial activity will be brought to a standstill while the manure continues to pile up in the lagoon, and even if the summer is warm the bacteria will not be able to cope with the backlog. Short spells of cold present no problem, providing the climate is favorable at other times.

Lagoons will not succeed in areas of very high rainfall; they will simply overflow. Ideally, the annual amount of rainfall should approximately equal the amount of liquid which evaporates from the surface of the lagoon.

Although bacteria need warmth, too much tropical heat presents a problem. It causes excessive evaporation of the liquid lagoon contents, and replacing this loss at regular intervals with fresh water has a disturbing effect on the bacteria. The ideal climate for a lagoon is a temperate one, without extremes of heat and cold and with a moderate, well distributed rainfall. Where such a climate exists, the lagoon system can provide a long-term solution to cage manure disposal problems.

Research has shown that lagoon capacity should be tailored to provide a minimum of 3.5 cubic feet per hen. If space allows, a lagoon should have plenty of surface area because increased liquid-air contact is beneficial to the right sort of bacterial activity. Extra depth cannot compensate for a shortage of surface area.

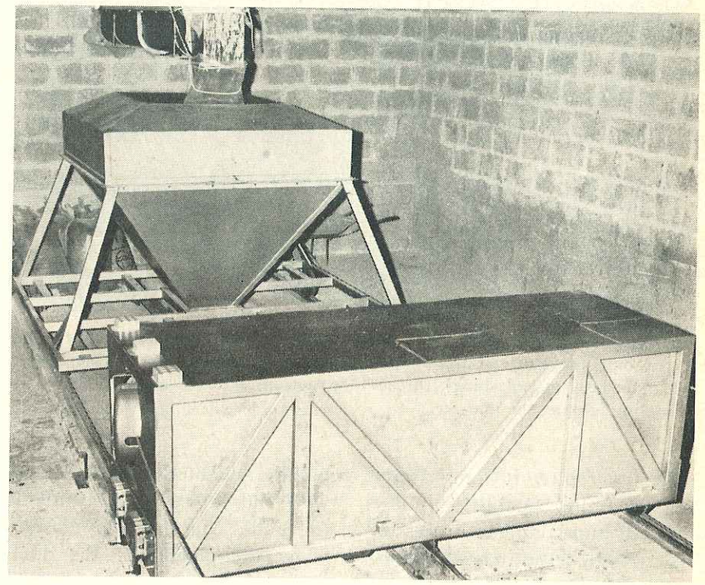
Oxidation Ditch. Providing sufficient space may be a stumbling block for many poultrymen with compact, intensive layouts. In this case, an answer may be found in a system recently developed by the Dutch which employs the lagoon principle, but in miniature.

It should be explained that there are two kinds of bacteria which digest animal waste. The first is the anaerobic variety, which can live and work without the need for oxygen. It is this kind which is most active in lagoons. The second variety is

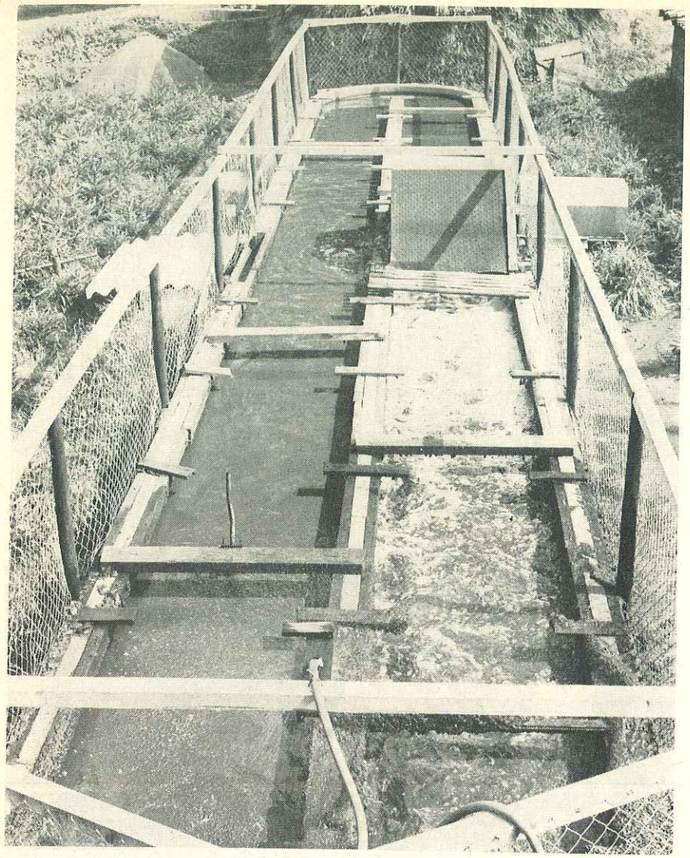
Le mois écoulé, Anthony Phelps a discuté les méthodes d'enlèvement des déjections qui sont à la disposition des producteurs d'oeufs pouvant utiliser le fumier sur leurs prairies ou champs. Ce mois-ci, Mr Phelps décrit les méthodes disponibles aux aviculteurs ne pouvant pas se débarrasser de la pouline sur leurs propres champs. Ces systèmes comportent: des lagons à fumier, des fossés d'oxydation, le séchage du fumier et la production de gaz méthane.

Vergangenen Monat hat Anthony Phelps die Kotbeseitigungsmethoden behandelt, die den Eierproduzenten, welche den Mist auf ihrem Weide- oder Ackerland verwerten können, zur Verfügung stehen. Diesen Monat bespricht Herr Phelps die Methoden, denen sich die Geflügelhalter bedienen können, welche nicht in der Lage sind, den Kot auf eigenes Land zu beseitigen. Diese Systeme umfassen: Güllesümpfe, Oxydationsgräben, Kottrocknung und Methangaserzeugung.

Lo scorso mese, Anthony Phelps ha discusso i metodi d'allontanamento della pollina cui dispongono i produttori di uova i quali possono utilizzare il letame pollino sui loro prati o terreni agrari. Questo mese, il sig. Phelps tratta i metodi a disponibilità dei pollicoltori i quali non sono in grado di evacuare la pollina sul proprio terreno. Questi sistemi comprendono: lagune per le deiezioni, fossi d'ossidazione, essicazione della pollina e produzione di gas metano.



ONE OF SEVERAL poultry manure dryers now available in Britain. An electrically powered drive unit (foreground) tows a hopper which spreads fresh manure in a shallow layer in an underfloor drying chamber.



AN OXIDATION DITCH on a small farm in the Netherlands. The manure-and-water contents are driven around the circuit by a paddle. The paddle (under cover to prevent splashing) thrashes oxygen into the liquid for bacteria to use in digesting the manure.

called aerobic. It must have oxygen and is capable of a more efficient and complete process of digestion than the anaerobic kind.

The Dutch mini-lagoon system is called the oxidation ditch and its function is to provide luxury working conditions for the more efficient, oxygen-loving aerobic bacteria. News about this development only broke quite recently, but already it has created world-wide interest among animal farmers with manure disposal problems.

When the oxidation ditch was first devised, it consisted of a circular channel around a small island. But in the interests of conserving space, it is now two parallel channels separated by a wall and linked by U-bends at the ends. Manure and dilution water are piped into the ditch daily.

Spanning one of the two straight stretches of ditch is a revolving paddle (the Dutch inventors call it a "brush"). It consists of a metal cylinder to which a mass of short angle-iron "fingers" are welded. Powered by an electric motor, the brush rotates at about 90 revolutions per minute.

The brush is mounted across the channel in such a way that only the tips of the angle-iron fingers dip into the liquid in the ditch, to a depth of 3 inches. Result: When the brush revolves, the fingers exert a thrashing action on the surface of the liquid.

The effect of this is to beat air into the liquid. The brush also sends the contents circulating around the ditch, and the surface turbulence which is set up as the liquid streams away helps in the process of aeration. The object of the aeration is, of course, to supply the aerobic bacteria with their vital oxygen.

The brush actually has a dual purpose. By keeping the contents of the ditch circulating, it speeds the disintegration of freshly loaded manure and keeps the solid particles in suspension in the liquid. This is as essential to the bacteria as the provision of oxygen.

Ditch capacity should be 1 cubic foot per 5-pound hen, and depth is limited to 4.5 feet if the brush is to keep the contents aerated and moving uniformly at all levels. Speed of circulation should be 12 inches per second.

Once a day, the brush motor should be switched off for an hour to allow the solid particles to settle at the bottom of the ditch. When sedimentation is complete, the top inch of liquid can be drained off. Analysis shows that, as a result of bacterial action, the liquid is 99.5 per cent purified and can safely be discharged into roadside ditches, waterways, and public sewage drains. Liquid removed from the oxidation ditch should be replaced with an equal quantity of water.

In an oxidation ditch of economic size, the bacteria can only digest between 70 and 80% of the manure solids fed to them. So there is a slow build-up of solid particles in the ditch which must occasionally be reduced.

Three times a year, after sedimentation, about 10% of the surplus sludge should be pumped out from the bottom of the ditch. Because it has been stabilized by bacteria, this sludge is odorless but still retains a high fertilizing value. It can be spread on a limited acreage, disposed of through a public sewage system, or dried.

Manure Drying. Drying is a method of manure disposal which, because of the high capital out lay involved, appeals primarily to the very large-scale egg producer.

The purpose is to produce an organic fertilizer in granular form which can be bagged, is clean to handle, and is marketable to horticulturists and gardeners.

Drying equipment is now widely available throughout the world, and the machines fall into three categories: 1. Flat-bed machines in which a layer of manure is "cooked" with hot air; 2. rotating cylinders, filled at one end and emptied at the other, in which the manure is dried by hot air and contact with hot metal; and 3. flash driers in which the manure is broken up and "spray-dried" in a hot airblast.

According to manufacturers, production costs vary between £5 (U.S. $14.00) and £9 per long ton of the end-product. Some manufacturers in Britain offer to buy back the dried manure at £8 (U.S. $22.33) to £9 (U.S. $25.10) per long ton, and have built up retail distribution outlets.

The prices gardeners are prepared to pay for 14-lb, 28-lb, and 56-lb plastic bags of dried poultry manure are attractive. But the poultryman who decides to do the retailing himself is going to find manure marketing a big distraction from the job of producing eggs unless, like the South African, he can turn it into his main source of income. Do not forget, however, that an egg producer with 20,000 caged layers will have 7 tons of dried manure to sell every week of the year.

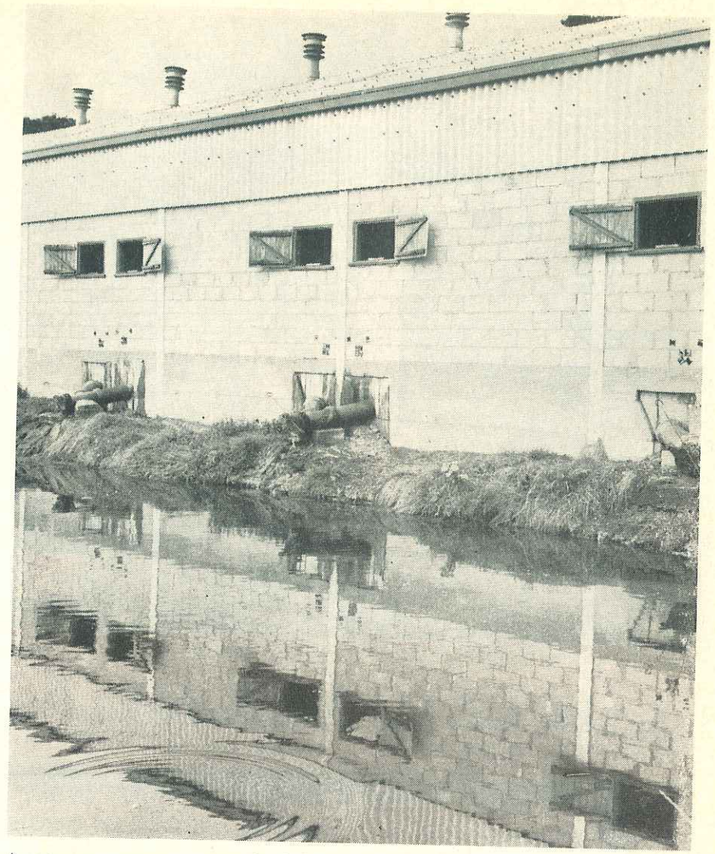
Of course, the price that can be asked for bagged, dried manure depends on its fertilizing value, and here is a snag. Thermal drying with hot air is really only a process of evaporating the moisture content of the manure, and in this process valuable chemicals are also lost.

Fresh poultry manure from the cages contains about 1.8% nitrogen, 1.4% phosphorus and 0.6% potash. Thermally dried material, reduced in volume by some 60%, usually contains 4.5% nitrogen, 3.0% phosphorus and under 2% potash.

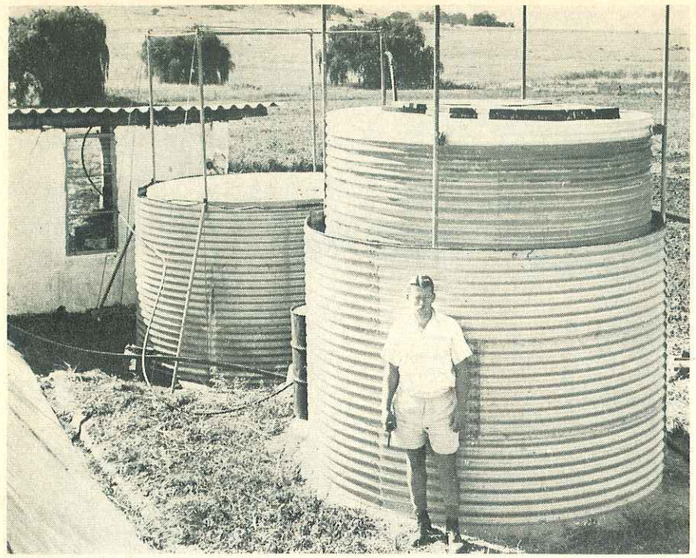
The most hopeful answer to the problem of lost chemicals appears to be a process called electro-osmosis. The principle is that electrons are passed through the fresh manure, where they pick up molecules of water as they go.

Electricity consumption is negligible and the equipment required for feeding electric current into the manure is not too costly. By itself, electro-osmosis dries too slowly to be practical, but by combining it with thermal drying, a British manufacturer has been able to achieve an output of 1 ton every 2 hours and to double the fertilizing value of the end-product.

Methane Gas. Perhaps the most exciting outlet for poultry manure is as a source of methane gas. When anaerobic bacteria



A LAGOON BESIDE a cage laying house in the United Kingdom. Manure from the cage stacks drops into underfloor channels where it is diluted with water. Once a week the outlet pipes from the channels are opened and the effluent flushes out into the lagoon. The water in the channels is merely used as a means for moving the manure.



TWO HOME-MADE GAS holders for storing methane made from manure are on the South African farm of Mr. L. J. Fry, (foreground), a farmer who has pioneered manure-gas production. Fry's farm is powered by the fuel for considerably less cost than that of the electricity and diesel oil used.

digest liquified animal waste, they generate a gaseous mixture comprising 68% methane, 30% carbon dioxide and a small amount of hydrogen sulphide.

This mixture is highly inflammable and explosive, with an equivalent rating to 120 octane petroleum (automobiles use petroleum with an octane rating of 93-100) and a net calorific value averaging 600 British thermal units per cubic foot. It is a clean gas which can be used for heating, lighting, stationary engines and even motor vehicles.

It is possible to produce the methane gas by the cold digestion process; in other words, at normal ambient temperatures. But this is very slow. The usual method is to heat the stored manure artificially to 85° or 90°F to accelerate bacterial action and the gas output. In tropical countries, of course, artificial heating may not be necessary.

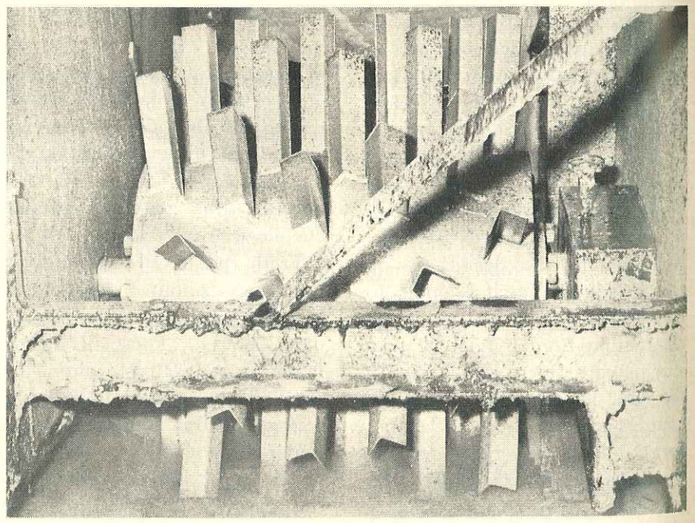
The procedure is to mix the poultry droppings with a little water, and feed the mixture into an air-sealed holder maintained at the correct temperature. It is essential that freshly added manure should be mixed with the sludge already in the "digester", but totally decomposed material should be removed periodically.

When the gas is created by bacterial action it rises inside the container and is trapped under a fixed roof. It generates its own pressure and can be piped off at intervals into storage tanks. If the gas is used to fuel an electric generator for poultry house and domestic lighting, the cooling water from the engine can be fed to the digester for heating purposes.

Digestion tanks can be of any shape and located either above or below ground. If artificial heating is necessary, the digester should be well insulated. In tropical areas it should not be insulated, so that solar energy can provide the necessary temperature inside.

The capacity of the digester should be based on providing 1 cubic foot for each 7-8 hens. The cost of the tank (at ruling European building prices) will be about £150-£200 (U.S. $420-$560) per 1,000 cubic feet capacity. Heating and gas collection machinery may cost £200-£400 (U.S. $560-$1120).

A pioneer in methane production from animal waste is Mr. L. J. Fry of Johannesburg, South Africa. (Also see story on page 44, *Poultry International*, March, 1967.) His own gas plant (han-



THE ROTARY BRUSH of an oxidation ditch is a metal cylinder to which a mass of short, angle-iron fingers have been welded. The tips of the fingers dip into the liquid with a thrashing action to beat air into the effluent.

dling the manure from 900 pigs) saves him over £1,000 (U.S. $2,800) annually in terms of diesel fuel previously used in an electrical generating plant.

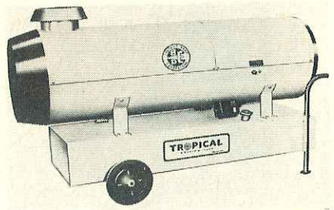
His gas-burning generator runs lighting on the whole farm, borehole pumps, spray irrigation, an alfalfa drying plant, and also provides electricity for cooking, water heating, and an immersion heater in a swimming pool. In addition, the gas is used as a straight fuel in stoves and refrigerators and as a flamethrower for weed control.

The decomposed material taken from the digestor is reduced in volume by over 50% but still has a valuable content of nitrogen, phosphates and potash if it can be applied as a fertilizer. It is of an ideal consistency for drying or pelleting as a packaged fertilizer.

In warm climates where the need for artificial heating in the gas plant would be minimal, and on farms in rural areas not served by grid electricity, converting poultry manure into power would seem to be a viable economic proposition and an easy way out of that embarrassing manure disposal predicament.—*End*

Product News

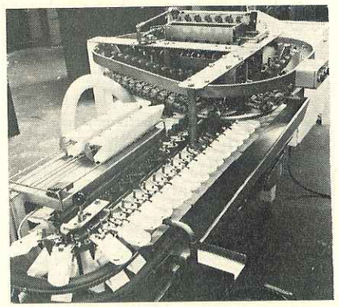
Space Heaters . . .



Two new portable space heaters fitted with special heat-exchanger units are marketed by Lawrence Edwards & Co. (Engineers) Ltd. Called the Mark III BX 150 and BX 300, the heaters have outputs of 150,000 and 300,000 BTU. Paraffin fuel consumption is approximately 1 gallon and 2 gallons an hour with operating times of 15 hours and 22.5 hours per tank of fuel respectively. The heat-exchanger units prevent the burner fumes from being exhausted into the main warm-air flow. The fumes are directed into the atmosphere outside the house. The machines cost £165 and £225.

For free information, circle 300 on postcard

Egg Breaking Machine . . .



The Stork automatic egg breaking and separating machine consists of a feeding, breaking and separating section to handle up to 7,000 eggs per hour. Only one operator is necessary. Made of stainless steel, the unit effectively separates egg yolks and whites and has a special device for the automatic discharge of empty shells. The machine is also designed to permit regular and automatic cleaning and disinfection of the separation tray during production.

For free information, circle 301 on postcard

Pest Control Unit . . .

The Vidrex-Corvair Pest Control Unit, manufactured by S. Causey & Co. (Vidrex) Ltd., spreads a microscopic vapor-film throughout the poultry battery, brooding or laying house interior to control red-mites, poultry lice, northern poultry mites, depluming mites, poultry spiders, fleas and flies. The unit is thermostatically controlled to prevent overheating and is fitted with a neon pilot light. Size: 6.5 in. by 5.5 in. Voltage range: 200/250 AC/DC.

For free information, circle 302 on postcard

Spray Washer . . .

The Kleenmaster spray washer, available from Anglia Machine Sales Ltd., is suitable for spraying oil, disinfectants, detergents, insecticides, and weed killers. The Kleenmaster will spray hot detergent and sterilizing solution and then, by a flick of a switch, will spray a cold water rinse under pressure. Light, compact and easy to maneuver, the Kleenmaster is under 2 ft. (610 m/m.) wide and weighs only 168 lbs. (76 kgs.). It works from any 15 × 13 amp. socket, single phase A. C. 230/250 volts. The unit can also be obtained in a 3-phase model.

For free information, circle 303 on postcard

Worming Compound . . .

One treatment of Appercol, a new wormer made by Janssen Pharmaceutica, is sufficient to control almost any adult or young Ascaridia, Heteraksis or Capillaria worms. Administered in the water, there is no danger of overdosing, no side-effects and no effect on production. Dosage is 40 milligrams of active product (tetramisolebase) per kg. of bodyweight, which is 1 milliliter per 10 kg. of chicken weight or 1 bottle per 2,500 kg. of chicken. The product is sold in plastic bottles.

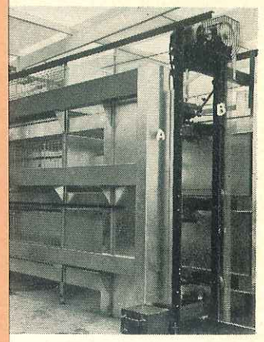
For free information, circle 304 on postcard

mechanism is operated by unlocking a safety switch and by pressing a start button. The first counter clicks from the pre-determined number down to zero and then switches off the first auger. Automatically, the second auger starts and finishes, and so on. Any number of augers can be operated.

and perfect seating. The conical wound spring prevents leaking by maintaining a positive shut-off in the closed position, yet requiring minimum tension on the ball. The valve is manufactured complete to reduce fitting time and maintenance.

For free information, circle 305 on postcard

g Cages



-automatic droppings removal atured in the 3-tier metal rearing g produced by Dunblane Cages ages also include a system of clip- y cage fronts to progressively vary ertures, floors fitted with roll-on, stic mesh matting for chick com- the first 10 days, and anti-waste ducts fitted to the feeding troughs to eliminate food spillage. Overall construction is of galvanised steel, with floors and fronts hot galvanised after manufacture.

Adjustable legs are fitted to cage blocks to ensure level.

For free information, circle 313 on postcard