

Waste handling: New solutions to an old problem

By **GEORGE HARRIGAN**, Associate Editor

A skyrocketing annual waste load that could reach 550 million tons by 1980 will cease to be a critical problem. Instead, it will become a matter of survival. Despite the "Federal action through financial and technical assistance" called for in Public Law 89-272, 89th Congress, S.306, it has remained for private industry to develop the necessary waste handling and processing equipment and systems. A review of that equipment and those systems appears on the following 19 pages.

The average citizen of the United States produces five pounds of trash every day. Combined with the total from industry, the sheer quantity of solid waste material to be disposed of in this country each year is estimated to be over 360 million tons. And this figure is growing. Our affluent society finds it easier to throw things away than repair them. Advanced technology has given us a whole line of indestructible plastics and detergents. And, the public demand for disposable products and nonreturnable containers has never been greater.

Examples of waste generated in industry are also impressive. The automotive industry generates a total of 50 pounds of corrugated trash for each automobile produced. In 1968 9,000,000 cars were produced. The result was 450,000,000 pounds of trash, and that's only corrugated. Then we factor in the broken pallets and crates, discarded dunnage, steel strapping, etc., and we begin to see the volume we're talking about: The United States produces enough junk to fill the Panama Canal four times a year.

Then we must consider both the expected population growth and a normal increase in industrial production. By 1980, we could be handling an annual waste load of 550 million tons. At that time the problem will cease to be critical. It will become a matter of survival!

At the present time, most methods for storing, collecting, and disposing of solid wastes follow an elementary system of gathering the unwanted materials, burning or compacting them to reduce their volume, and burying them at convenient locations. But Federal and State regulations on incineration and landfill are becoming stricter. Lack of proper air pollution control devices have forced

many plants in urban areas to shut down their burning operations and turn exclusively to dumping. This increasing dependence on landfill is creating a number of problems. As present disposal sites become filled, trash must be hauled greater distances. This increases the cost and creates political problem as larger cities seek to acquire dump sites in neighborhoods outside their political jurisdictions. In addition, of the 12,000 land disposal sites in the United States, only six percent meet even the minimum standards for sanitary landfills.

The Federal Government took a major step against the tide of environmental pollution in October, 1965, when President Johnson signed the Clean Air Act Amendments and the Solid Waste Disposal Act (Public Law 89-272). Since that date, an intensive effort has been made by several universities, city governments, and non-profit organizations to devise methods and systems for eliminating much of our country's physical degradation.

Industry is also becoming more aware of the growing solid waste problem. No one in industrial management can overlook the fact that continuous pollution of our environment is poor public relations. But even more important to the industrial complex, refuse collection and disposal is becoming an economic factor. Excessive handling of trash at the point where it is generated can cut deeply into corporate profits. Here is a concrete factor which business understands. The next few years will see vast strides in the development of new waste handling techniques as American industries strive to achieve the most efficient means of disposing of trash at the lowest possible cost.

Solving the waste handling problem in a typical plant involves three different areas of activity — collection, transport, and disposition.

Collection equipment is becoming more sophisticated. Some plants use small compaction units stationed at different sections of the building. Others maintain refuse collection trains or portable compactors which run on regular schedules throughout the factory.

At many truck docks, compactor and roll-off container combinations serve the dual purpose of volume reduction and transfer. Trash is dumped into the compactor, reduced in volume approximately four to one (depending on the

type of material to be compacted), and the loaded container is carried to a dump site on a specially constructed roll-off truck.

A great deal of interest is being shown in the area of waste processing. Shredding and baling have a promising future for applications in solid waste handling. They offer advantages in volume reduction and result in a better utilization of landfill areas than possible with conventional dumping methods.

The incinerator people have not gone out of business, either. They are developing devices which will eliminate

Waste handling:

In-plant collection equipment

Although the old steel trash can is still widely used, discriminating plant managers are turning more and more to the wide variety of new ideas for collecting in-plant refuse.

Collection and distribution to a central container may be handled by conveyor, wheeled container, powered cart or portable compactor. Choosing the correct one depends

upon factors such as volume of trash, aisle width, ease of handling, etc.

If a compactor is used, the compactor manufacturer may even have a full line of carts designed to suit the compactor's dumping mechanism.

The following illustrations are good examples of typical equipment. Perhaps there's one to suit your plant.

Rugged pickups are powerful, dependable



The Haulster from Cushman Motors is available in a choice of four standard models and 8, 12, or 18 horsepower. All are rugged, powerful and dependable vehicles designed for light hauling and towing applications. Haulsters can go where other vehicles can't, and have a small 17-inch turning clearance circle. Precision engineered and ruggedly constructed, the Haulster needs little attention and performs a variety of duties in thousands of plants from coast to coast.

The largest of the four models is the Wide Bed with an area that's 53 inches by 57 inches. Ideal for in-plant refuse collection, this model features mechanical dumping of the full 1,000-pound capacity.

All four models are suited for hundreds of different uses that include carrying refuse, parts, equipment and tools. The model shown is the Cushman electric "Executive" with cab.

Dust-free cleanup with vacuum loader and cleaner

The D P Way Corporation of Milwaukee has perfected a dust-free, large-capacity, mobile vacuum loader and cleaner for use with a variety of industrial waste materials.

The Model 350 Ultravac industrial vacuum loader is powerful enough to handle foundry sand, flue dust, fly ash, mill scale, metal chips, and Portland cement—any material

that will fit through the unit's hose up to a bulk density of 200 pounds per cubic foot. Ultravac also provides a 150-foot reach for removal of dirt from roofs, cranes, and pits.

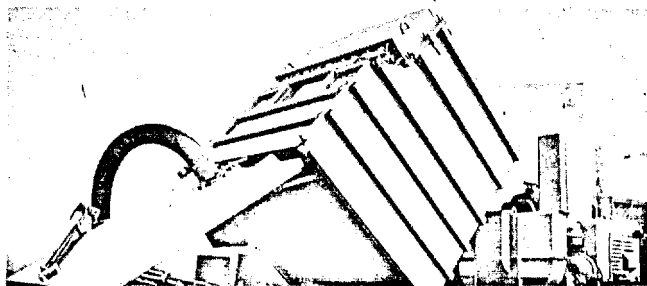
The machine has a 4-cubic-yard capacity and a tight turning radius. In addition, a continuous dust filtration system traps and holds minute dust particles within the collector's

most of the pollution. Approved For Release 2002/05/07 : CIA-RDP86-00244R000300390060-6
 these devices add to cost so most incinerators now available exceed the price range smaller plants and communities can afford. But manufacturers are working on this factor. New ways may soon be found for lowering incineration costs.

For cases where the dump sites are far from the municipalities, the transfer station has been developed. Regular refuse haulers dump their loads into centrally located containers of much greater size. These in turn are hauled to the landfill area many miles away, saving equipment and man-hours and amortizing the cost of the

In any case, all of these new innovations in waste handling point to the fact that solid wastes are no longer being swept under the rug. Today, solid waste represents in its collection and disposal a \$5.0 billion dollar industry. And that figure is rising. New companies are getting into the picture every day. Established equipment and systems manufacturers are constantly seeking new methods and ideas in order to stay on top of the problem.

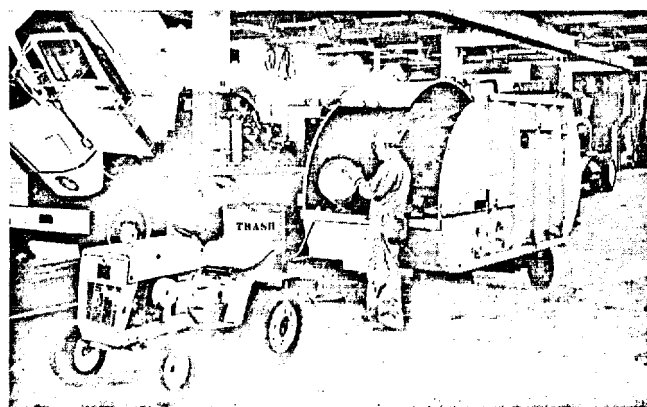
In the following pages MHE presents a picture of solutions offered by the latest in solid waste equipment, systems, and ideas.



body making the entire operation dust free. The system is self-cleaning and requires virtually no maintenance.

Three hose diameters are available—6 inch, 4 inch and 2½ inch—in lengths up to 150 feet.

Portable compaction unit saves \$400 per month



At the Aerodex, Inc. plant in Miami, Fla., in-plant waste was handled in 55-gallon drums. By switching to a new M-B MotoPack portable compactor unit, waste collection costs have been reduced by an estimated \$400 monthly and man-hours have been cut by 40 hours a week, maintenance superintendent W. B. Lincoln reports.

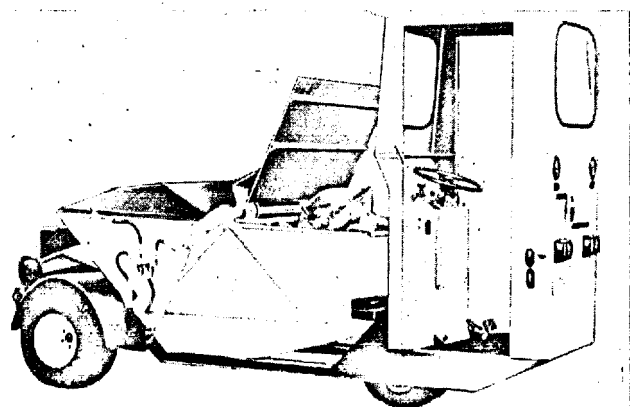
The Moto-Pack is towed by a small industrial tractor to various waste generation areas within the plant. At each stop, the operator dumps a load of waste—paper, steel strapping, cardboard or excelsior—into the loading hopper of the compactor. Each load is automatically compacted

by a powerful hydraulic system until the maximum 5-cubic yard capacity is reached.

When fully loaded, the compactor is towed to an outdoor loading dock where the tightly-compacted material is automatically ejected through the rear of the unit into a private hauler's collection truck. Four to six collection trips are made daily.

The Moto-Pack is a product of the M-B Company, New Holstein, Wis. It is a completely self-contained unit having a hydraulic compaction system much like the typical municipal garbage-refuse truck. It may be equipped with either a gasoline or L-P gas engine to power the hydraulic pump. Loading compaction and load ejection are handled automatically with "one-lever" operation.

Refuse carrier uses the one-man principle



This new satellite garbage packer from Sani-Systems, Inc., New Hampton, Iowa, works with large trucks and needs only one man for driving, picking up and unloading.

The large-capacity, two-cubic-yard machine packs as much as 40 standard trash cans for greater efficiency. Sani-tarrier's design features forward and backward travel without having to turn the vehicle around. This permits speedy and safe loading and unloading.

The system permits either curb, door or in-plant pickup for reduced handling. Exclusive covers pack refuse and eliminate littering.

Waste Management

Containerizing means bigger payloads, better housekeeping

At present we are in an interim period. We know that someday someone will come up with a device that disposes of solid waste materials completely, right at the plant site. We'll just push a button and the refuse will be gone — no smoke, no ash, no unpleasant odors.

Unfortunately, the device hasn't been invented yet. Until it is, we are committed to landfill as the primary method of ultimate waste disposal. This being the case, industry must have a sanitary method of storing waste and an efficient means of transporting it to disposal sites. Compactor/container combinations and mobile hauling equipment give just this type of service. They eliminate incineration, provide boxing of all waste material at one central location, and maintain good housekeeping. No trash-filled, fly-infested open container is left standing out behind your plant. Other advantages of containerization are:

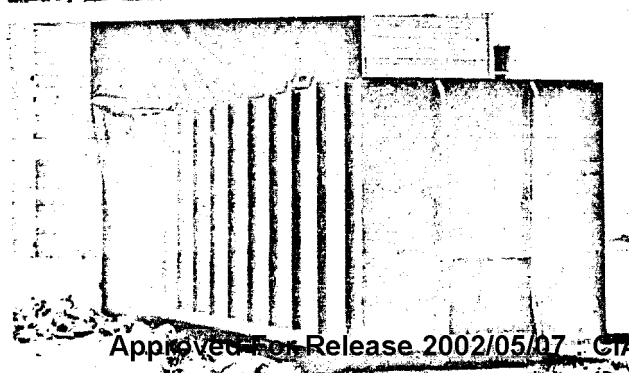
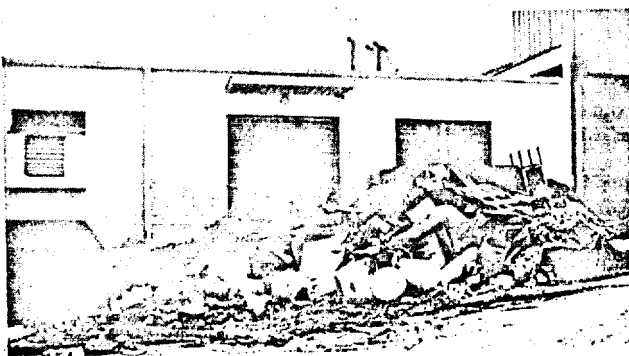
- Cost savings: Compressing large amounts of trash into one container means fewer pickups, fewer fees for service.

- More useable space: Many older industrial buildings and department stores have rooms set aside for rubbish storage. This takes up valuable space and presents a constant fire threat. Containerized storage releases this space for more productive use.

- Pilferage is prevented. When trash is taken out of a building and dumped directly into a compactor, after-hours retrieval of merchandise hidden in among the cartons is impossible.

The following illustrations are good examples of available containerized handling equipment. In addition to stationary compactor units, we have included other specialized types of solid waste handling equipment which may prove even more economical for certain applications.

Stationary compactor handles 200 yards of waste daily



How do you get rid of 200 cubic yards of industrial trash every day? This was the problem of Jim Shaffer, plant manager for the Smithers Company in Kent, Ohio. The company manufactures a plastic foam material used in making floral displays. The refuse piles up from raw material containers and a large volume of foam waste.

As production increased, the cost of refuse disposal grew steadily. The independent hauler who serviced Smithers was just managing to stay on top of the situation. The eight containers which he supplied held a total of 44 cubic yards. Some days production generated more waste than they could hold, even with three daily collections. When this happened, the overflow was dumped on the ground and two employees had to spend two hours each collection stop helping the hauler load the over-flow into the packer truck. The over-flow of trash was unsightly, unhealthy, and constituted a fire hazard.

Determined to find a solution, Shaffer and McFarland (the refuse contractor) decided on a Perfection-Cobey containerization system. It consists of a Cobey stationary packer, two 40-cubic-yard steel containers that hook up to the packer, and a Fleetainer truck that picks up loaded containers and takes them to a landfill for dumping.

Shaffer purchased the Station-Pak and containers for the Smithers company, and McFarland bought the Fleetainer

roll-off truck. The refuse is collected in 1-cubic-yard wheeled containers in various parts of the plant. These are then rolled to the packer and dumped. The Station-Pak can be set on time, automatic, or manual control cycles. It digests refuse as fast as it is dumped into the hopper, packing the 200 yards of

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The system has been in use for one year. It has eliminated most of the problems of the old system, and has the capacity to handle three or more times the current volume. Shaffer estimates that his collection costs have dropped by more than 50 percent.

New packers come in three sizes

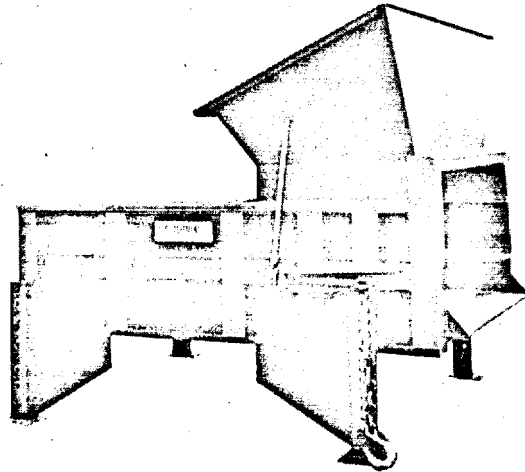
A new line of stationary packers in three different sizes is now available from the Mid Equipment Corporation, Grundy Center, Iowa.

The Model 100 is designed for use with any container from 2 to 40 cubic yards in capacity. The charging hopper has a capacity of 1 yard, and the charging ram provides a packing force of 25,000 lb.

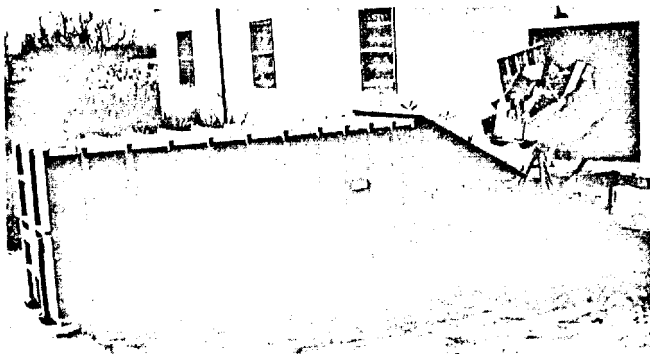
Model 200 is designed for light industrial use and commercial applications. Its charging hopper is rated at 2 yards, with a ram displacement of 1.25 yards.

The 400 series has a ram force of 40,000 lb., a ram displacement of 2½ yards, and a 4-yard hopper. All models are equipped with pushbutton controls and an over pressure key switch.

These packers handle all types of material. The ram force breaks packages against a heavy-duty breaker bar and forces the crushed refuse into the container.



Refuse removal system works indoors or outdoors



The Anchorpac refuse removal system is a clean, efficient and simple method of solving the complex problems of industrial waste removal. Produced by the Anchor Machine Company, Jackson, Michigan, the system consists of three basic steps—loading, compacting, and removal.

The heart of the system is the Anchorpac stationary compactor. Available in capacities from 1.8 to 8.2 cubic yards, these compaction units compress refuse into transportable containers with up to 20-ton net load, and handle materials ranging from barrels and pallets to paper and corrugated boxes.

Inside the plant, trash is collected in steel Anchortilt carts located at strategic refuse generation points. When filled, they can be towed five at a time through a minimal 10-foot aisle to the packer. There, a special tilting device upends the carts into a hopper on top of the compactor.

The long stroke of the compaction ram pushes the material into the closed Anchortainer, compacting the refuse from three to five times. When the container is loaded, a special Anchor mobile hoist truck backs up to the container, picks it up, and transports it to the nearest sanitary landfill.

Many industrial plants have altered their buildings to make the system more accessible. A through wall installation—compactor inside, container outside—provides protection from the elements and loading convenience.

Refuse packer increases payloads, reduces costs

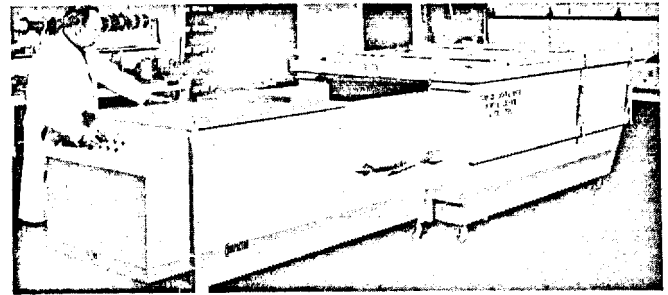
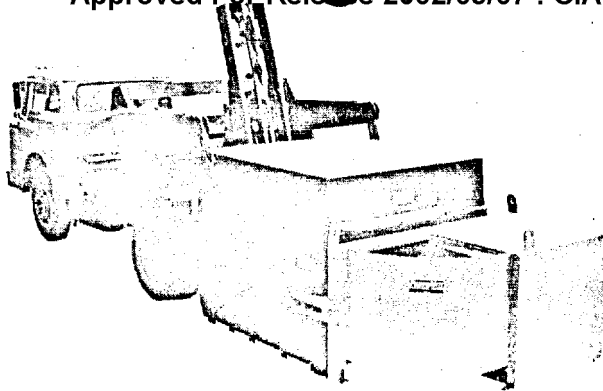
The PowerMite stationary packer manufactured by Dempster Brothers, Inc., Knoxville, Tenn., is an ideal unit for light industrial use, hospitals, schools, or office buildings. It's perfect for locations where space is small and there is a gradual accumulation of waste.

The unit may be loaded from ground level or from a loading dock. At the push of a button, the PowerMite's hydraulic cylinder exerts more than 42,000 lb. of pressure against the packer head, assuring maximum compaction for large pay loads. Trash is compacted into steel containers. As the container fills, the material is reduced in volume at realistic compaction ratios of up to four to one.

When the container is full, a truck-mounted handling

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New firm new compactors



unit picks it up, hauls it to a disposal area, and returns the empty container to its original packing position.

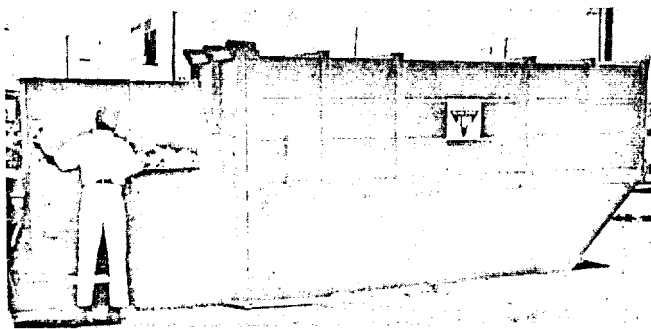
In addition to the PowerMite, Dempster manufactures a complete line of stationary packers for high speed handling of high volume refuse. Operating on the same principle as the PowerMite, these packers generate tremendous internal pressures, packing waste materials of all types into a wide range of reinforced Dinosaur storage containers.

Two Seattle companies have formed a joint venture to produce and market low-pressure compaction systems for business, industry and government. ComCo (the Compactor Company) was formed by the Seattle Tent & Fabric Products Co., and Amadyne, Inc. Their first refuse compactor unit is already on the market.

The machine was tested in a series of trials at the Boeing Company's 747 superjet assembly plant in Everett, Washington. It reduced in-plant refuse collection costs by 64 percent. Boeing now has 42 units at Everett.

The compactor operates at the point of refuse collection. Using the low-pressure system, refuse is compacted into a cardboard container inside the compactor. After full compaction, a pallet lifter chain is released and the boxed refuse slides easily out to be sealed and shipped. The boxed refuse may also be moved by forklift truck or pallet jack.

Compactor puts the squeeze on refuse disposal costs

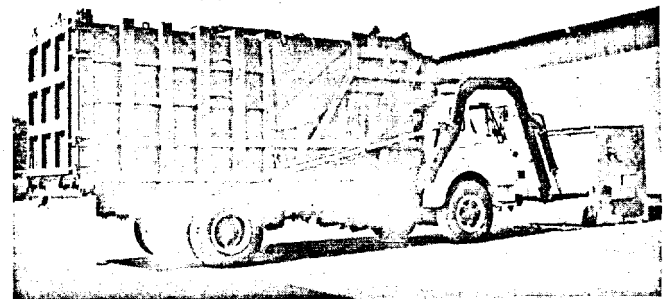


The Tri-Pak System produced by Industrial Services of America, Louisville, Kentucky, is an excellent example of a completely integrated containerization system. ISA not only builds the equipment, but distributes it, services it, and hauls the loaded containers to its own landfill.

The heart of the Tri-Pak system is the stationary compactor. The unit may be easily installed in a minimum amount of space at a dock or in an open yard. No segregation of refuse is required. Everything goes—waste paper, cardboard, pallets, skids, garbage, and barrels. All this is crushed, broken and compacted automatically into detachable haulaway containers by 90,000 pounds of compaction force. ISA compactors are available in seven models with capacities from 50 cubic yards per hour to 450 cubic yards per hour.

The containers are built to withstand compaction ratios of 20 to 1 depending on the type of material, and are available in capacities of from 15 to 60 cubic yards. Open containers for fly ash and sludge handling are also available.

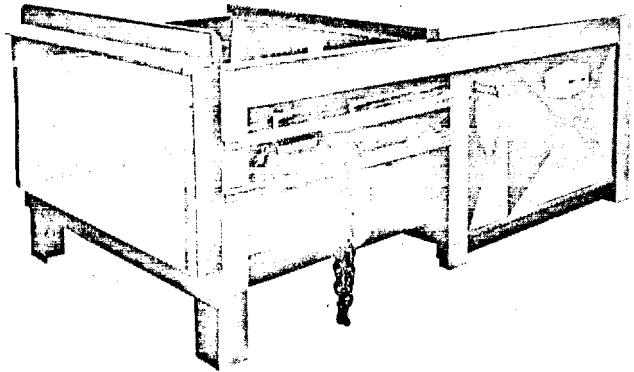
Truck-mounted compactor serves from coast to coast



The Dempster Dumpmaster is one of the most efficient and lowest cost systems for refuse storage and collection. Manufactured by Dempster Brothers, Knoxville, Tenn., the Dumpmaster system consists of a number of detachable storage containers placed at points of waste accumulation. As these containers are filled, a truck-mounted compactor makes its rounds, picks up each container, and empties the contents into its packer body where the material is compressed to a quarter of its former volume. This allows the Dumpmaster to haul the equivalent of many truck-loads of material on one trip to the disposal site.

The driver handles the operation from the cab. To pick up containers from ground level or from a dock, lifting forks and clearance arms are aligned with the container's side channels. The truck moves forward, the arms enter and engage the lifting channels, and the container is carried up to the hopper opening. Once over the hopper, the container is inverted, the lid swings open by gravity, and the refuse is dropped into the packer.

The Dumpmaster's "full-stroke" compression system enables it to achieve a much higher density than "short-stroke" or paddle-type systems. In addition, the Dumpmaster does not have to be tilted for load-dumping. The back door is simply unlatched and the packer plate is run through the truck body clearing the load straight out the back.



containers, assuring fast and positive container replacement. The attachment of two chain hooks to the container is the only manual labor required. A single lever activates the hydraulic system, pulling the container up tight. A wedge-shaped island achieves accurate alignment by centering the container while the twin hydraulic cylinders are pulling.

The compactor is also equipped with a sump for maintaining a dry floor at all times. The sump may be permanently attached to a sewage system, or a sump pump may be added.

The Sani-Pac may be operated manually, electronically, or sequenced by counters or other sensing devices. A toggle switch converts the controls from "dead man" to automatic operation. Heavy gauge construction assures years of trouble free service.

Bag packer handles refuse from apartments



The E-Z Pack Bag Packer built by Hercules Galion Products, Inc., Galion, Ohio, is a stationary refuse compactor designed primarily for handling refuse generated in apartment buildings and multi-dwelling housing units.

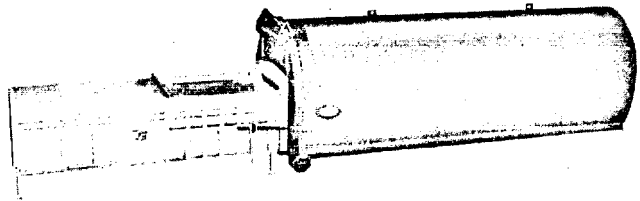
The machine packs against a bulkhead which is opened for ejection of the packed load. It can be emptied into a waterproof paper bag (up to 4 cubic feet in size) or into a garbage can. Packed material is ejected in the form of a slug whose weight can be controlled to meet local usage specifications. The Bag Packer is operated by an electro-mechanical system and contains a sonic device to automatically actuate the packing cycle.

Automatic sanitizer and chute cut-off devices are available as optional items.

Stationary compactor assures fast container replacement

A new stationary compactor has recently been developed by Sanitary Controls, Inc., Deer Park, New York. The Sani-Pac uses hydraulic power to compress refuse into a container.

New disposal system compacts refuse in a minute



A new low-cost waste disposal system is being offered by Uhrden, Inc., Sugarcreek, Ohio. The Tubar Pak Trash Basher makes it possible to pack at least 220 cubic yards of waste material into one 40-cubic-yard container for a single trip-load to the dumping area.

The system is comprised of a stationary compactor located at a central waste collection point. By pushbutton operation, the refuse is compacted into completely enclosed, fire-resistant haul-away containers which can be furnished in sizes up to 54 cubic yards. Compaction is accomplished with a force up to 48,000 lb. The system also includes a Tubar Dumper which lifts and empties all types of refuse containers into the compactor.

Trash Basher are available in .5-, 1.25-, and 2.5-cubic-yard capacities. Power is supplied by an electric motor coupled to a hydraulic system. The automatic packing cycle

Waste handling: Looking ahead: the rise of the transfer station

The direction solid waste handling takes in the future will hinge almost entirely on economics. The amount of trash being generated is rising and suitable landfill sites in and around the larger cities are racing toward extinction. In a short time the length of the hauls will increase as much as 8 to 10 times and the cost of transferring the trash to these far-flung dumps will skyrocket.

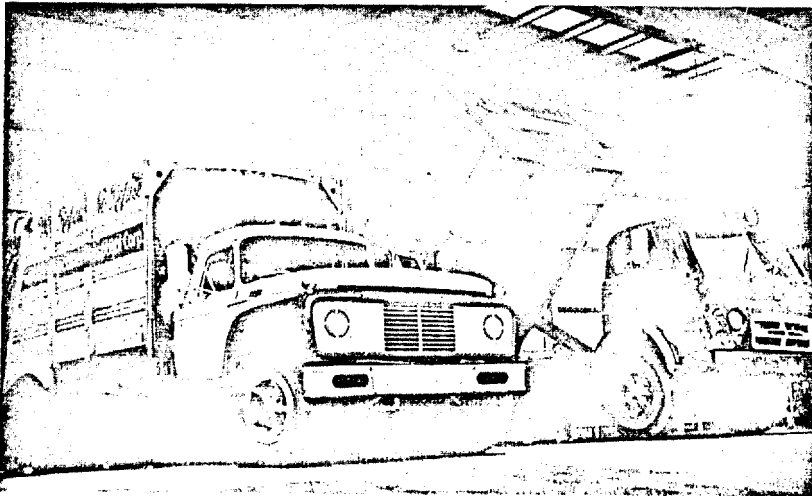
As a result, many municipal and industrial planners have been looking with interest at the idea of centrally located transfer stations. Correctly implemented, these stations can save collection haulers a great deal of valuable time, labor, and equipment wear.

Instead of loading his truck and heading for a distant landfill site, a hauler drives to the nearest transfer station, dumps the refuse into a central container, and returns to his route. For this service he pays a fee based on the

weight of the load. The fees collected from the haulers finance the operation of both the station and the landfill, and offer a far cheaper alternative to the private collector than making a trip to the landfill himself.

Transfer stations are usually equipped with a number of large stationary compactors and transport trailers. When one is filled, a semi-tractor pulls it to the landfill and an empty trailer is set in its place. In some cases, where the landfill is an unusual distance from the station, or where state laws governing legal weight allowances interfere, railroad piggy-back refuse handling is probably the answer. In any event, the transfer station concept is no longer on the drawing board. A number of stations are now operational across the country and many more are planned. The following examples are good illustrations of this concept.

Refuse-transfer stations save collectors time and trouble



The Dempster dumping system allows several trucks to dump material at the same time.

A single transfer station is handling 300 tons of refuse daily for the city of Lancaster, Pa., and its six surrounding townships. Outfitted completely with Dempster Bros. components, the Lancaster station is the newest of a series of Dempster-equipped facilities operating across the country.

Lancaster was faced with the same problem confronting many other growing cities. It ran out of nearby places to dump its trash, and had to go 17 miles out of the city to find a new landfill site. The city had two alternatives. They could invest in an expensive incinerator, and then still have to bury the ashes, or they could build a transfer station and solve the long-haul problem at a fraction of the cost.

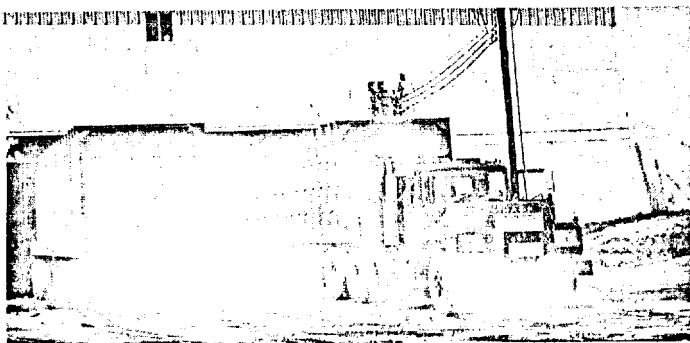
As it turned out, the entire transfer operation cost only \$385,000 as compared to a minimum of \$7,000,000 for an incinerator. This included the two-acre land site, grading, paving, and fencing the station and its equipment, a scale and scale house, a small office, and five Dempster transport trailers. The compactors, transfer trailers, and hydraulic push-pit units are all standard Dempster devices. No costly special engineering was required.

The Lancaster transfer station is a smooth running operation. Haulers using the station enter through a drive-on 30-ton Toledo scale which records the weight and truck number. The driver pulls up to the facility, turns his vehicle around, and backs into the station. If the truck is equipped with a dumping device that empties the load automatically,

The ejection plate of the Push-Pit travels on high density, abrasion-resistant guide shoes to push refuse into the packer hopper.

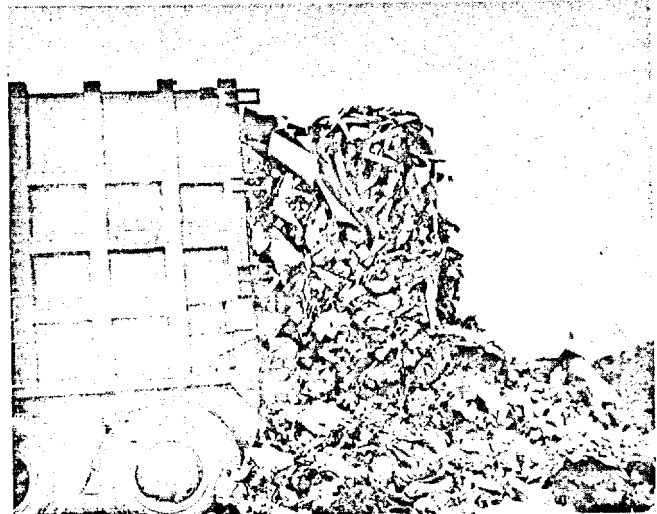


Refuse from the pit is about to be shoved into the compactor. The material shield is in place while the loaded trailer is pulled away.



The big transport trailer remains attached to the compactors until filled. Then tractor units pull them to the landfill.

Meanwhile back at the landfill . . . a push-out device unloads the compacted rubbish and the empty trailers are returned to the station.



stalls that feed directly into a Dempster stationary packer on the lower floor. The packers then push the material into attached 65-yard Dempster transfer trailers. When a trailer is filled, it's hauled to the landfill and an empty trailer is set in its place.

Vehicles which have to be unloaded by hand back up to the 10-foot-wide refuse storage pits located on each side of the center stalls. These pits are also used by trucks with automatic dumping devices when traffic at the station becomes heavy. The pits have enough temporary storage capacity so that haulers need not wait to dump loads.

Both pits are equipped with Dempster pit push-out systems. At periodic intervals an operator activates a traveling telescopic hydraulic

shoves the refuse to the center stall and pushes it into one of the stationary compactors located below.

The compaction process is a continuous operation. A shield automatically covers the packer opening during the compaction cycle. This keeps material from falling behind the packer's head and allows refuse haulers to continue dumping without interruption. When the packing head finishes its cycle and returns to the ready position, the shield retracts and any refuse on it falls into the compactor and is pushed into the trailer on the next cycle.

The station operates 9½ hours per day, five days a week, plus 8 hours on Saturday. Haulers using the station pay a fee based on weight of their load. These fees cover the costs of the station and the cost of the refuse to be landfilled.

Rubbish-by-rail solves long-haul problems

The Anchor Machine Company of Jackson, Michigan, believes there is a simple answer to the problem of hauling refuse to distant landfill sites. With their new Anchorpac "Rail-Tainer Disposal System" they feel that they can economically load, transfer, and unload rail cars in such a manner that the transfer of wastes to remote areas is not only feasible, but desirable.

The Anchor system is presently under serious consideration by two cities, Milwaukee and San Francisco. The Milwaukee program has been tentatively approved, and a joint bid for the work has already been accepted from the Chicago, Milwaukee, St. Paul & Pacific Railroad, and the Acme Disposal Corp. Only a few wrinkles have yet to be ironed out and the project will be under way.

The system will operate in this manner: The different communities and private haulers in and around the Milwaukee area will haul their waste materials to three transfer stations to be constructed by Acme.

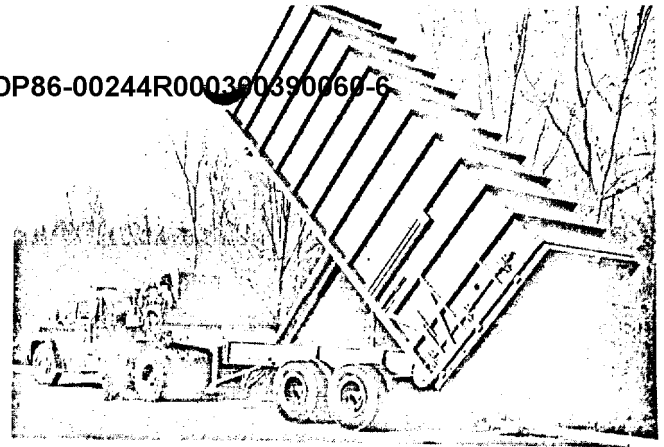
As trucks and other refuse vehicles arrive at the transfer station, a drive-through scale weighs the load and records the weight. The load weight is then relayed to a central control point inside the station. When the trucks pull up to the dumping area, each driver is instructed into which of ten available hoppers to dump his load. With an estimated unloading time of five minutes per truck, the transfer station can handle 120 loads per hour.

Each hopper feeds into an Anchor Model P-70 stationary compactor. These Anchorpacs are capable of compacting 10 cubic yards of refuse per minute into specially designed 107-cubic-yard enclosed steel containers with 30 ton capacities.

When the container is fully loaded, a switch crew detaches it from the compaction unit and pulls it straight ahead to the transfer dock. An empty container is pushed into the vacant slot and the loading process begins again.

A number of special Flexi-van flatcars will be sitting at the transfer dock. The Flexi-van has a self-contained loading unit which picks up the loaded containers, rotates them 90° and sets them in place on its bed. Each car carries two containers.

At the end of each day's operation, a train will arrive and pick up the loaded flatcars from the three transfer stations. Arriving at the landfill, large carriers will remove the con-



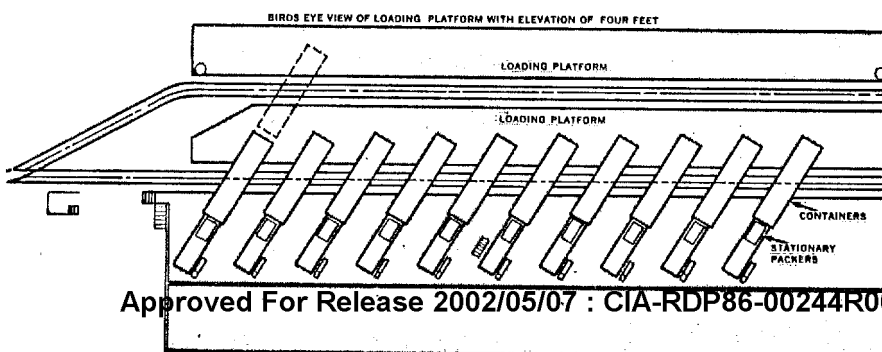
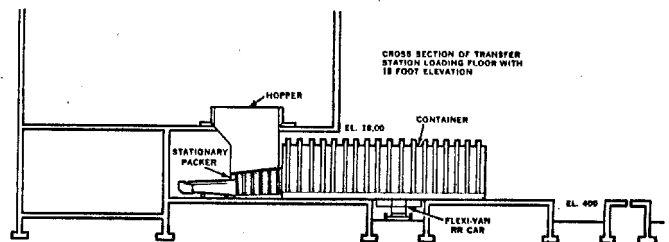
tainers from the railcars, haul them to the disposal site, and unload them. Then the empty container will be washed and returned to the train for same day transfer back to the loading station.

The city of San Francisco is making plans for a similar system using Anchor equipment and railcars. For 40 years it has been dumping its refuse into the mud flats of Brisbane Bay. A lawsuit will halt this practice in less than 18 months. If a new location isn't found soon, 1,500 tons of rubbish per day will pile up in the streets.

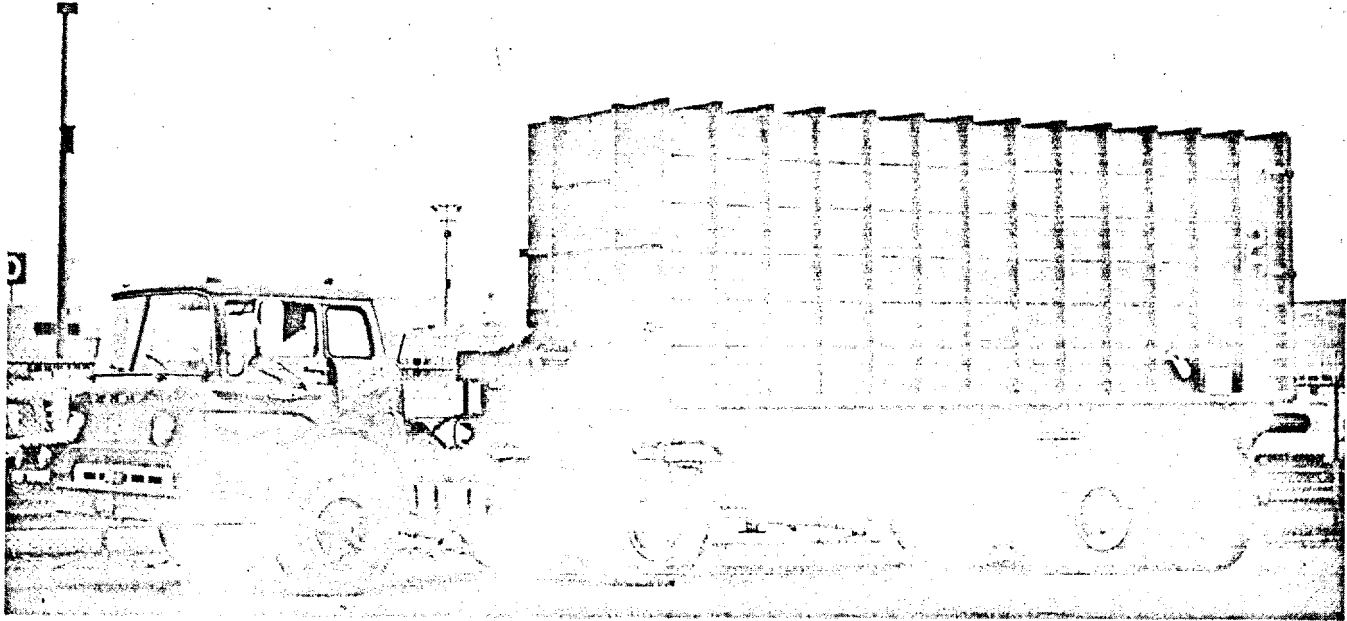
As a result, contract negotiations are going on between Western Pacific R.R. and city officials for daily rubbish runs to Lassen County some 375 miles away. Not only will this proposed rail transfer system solve the problems of San Francisco, but Lassen County is looking forward to a bright economic future as the garbage dump of America.

According to Dick Uptegrove, a Lassen County official, "The county is hard pressed for money and we're looking for new sources of revenue. We've got enough wasteland to last 500 years.

"If San Francisco ships us 1,500 tons of refuse a day, paying us 21 cents per ton for landfill disposal, that's \$113,400 a year. Garbage will be the biggest economic boost in the history of our county."



Three-phase disposal program reduces costs, boosts efficiency



A three-phase solid waste service program encompassing collection, salvage, and disposal is being offered by Industrial Services of America, Inc., Louisville. In taking a systems approach to the problem of solid waste handling, ISA feels that they have an economical method of disposal whereby industry and communities alike can cut costs and still comply with Federal, State and local regulations.

According to Harry Kletter, president of ISA, the company is following a "total concept" idea in its approach to the solid waste problem.

The firm manufactures its own line of refuse compaction and removal equipment, provides collection and transfer service, and operates its own sanitary landfill. In addition, they've developed a waste disposal processing plant which

allows them to separate, salvage, grind and compact unusable residue, and market the salvaged materials.

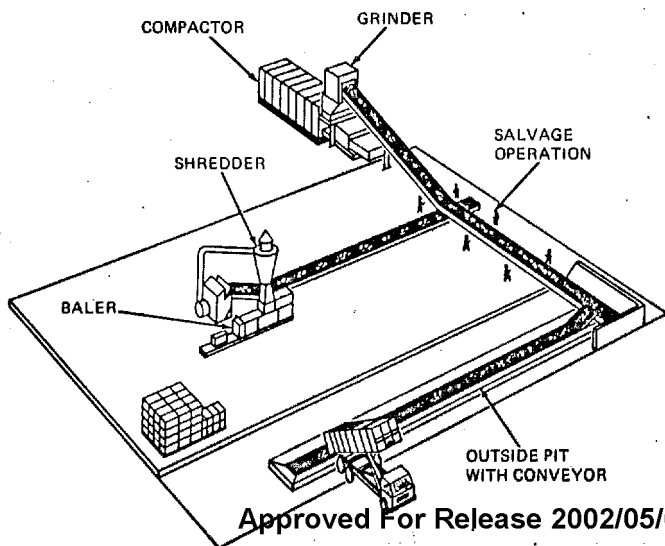
This processing plant is the heart of the system. Refuse is brought in by both ISA and private haulers and dumped in a long narrow refuse pit in front of the building. A steel slat conveyor built into the pit moves the refuse into the processing plant and on to another conveyor which carries it through a salvaging operation. The interior conveyor moves at a slightly faster speed than the exterior feeder. This spreads the incoming rubbish out along the conveyor making salvageable waste easier to spot. As the refuse moves past a reclaiming station, workers hand-pick cardboard, paper and scrap wood and toss it onto a third conveyor which takes it to a grinding and shredding machine. The shredded material is then baled and stacked in a storage area ready for resale.

Unreclaimable refuse continues on past the reclamation station into a large grinding machine. From there, it is fed automatically into a stationary packer, recompressed, and transferred to ISA's landfill.

Mr. Kletter pointed out the many benefits of this system to MHE. First of all, salvage can reduce the amount of landfill required by as much as 50 percent for disposal of the balance of residues. This would double the useful life of the landfill and cut the number of hauling trips.

Also, grinding the unreclaimable residue before hauling it adds further savings because it allows you to haul denser loads. And, the ground up refuse makes for a more tightly compacted landfill. This means that the land could be used for building purposes after a much shorter time.

Kletter said "Developing our program fully will take big money, so we've been looking at our capital." He anticipates stock will be sold to the public this year.



Waste handling: Processing may be the answer

At the present time, the most suitable method of disposing of refuse in most situations is to collect it, compact it into large containers, and haul it directly to a sanitary landfill. But the solid waste industry is no different than any other. The technology is not going to stand still. New developments in processing and disposal will continue to move the industry into areas of greater sophistication. Among the processes being studied are baling, pulverizing, shredding, and anti-air-pollution incineration. In each case the aim is identical: find a clean, efficient, inexpensive method of getting rid of the nation's trash.

Before the great furor over air and water pollution, incineration was the most acceptable method of reducing the volume of material to be buried. But, the future of incineration will depend almost entirely on economics. With the price of a super-type municipal incinerator com-

plete with anti-pollution devices estimated at upwards to \$15,000,000, other types of processing and disposal systems will have little trouble competing. There are a few low cost incinerators on the market which meet even the strictest pollution requirements. But they are limited in size and could not begin to handle the great volume of waste generated by an entire municipal/industrial complex.

Grinding and shredding of solid waste is presently limited to a narrow area of application. Large grinders are valuable in steel scrap yards for reducing automobiles and other bulky refuse to easily handled particles. Smaller shredders are used primarily for attaining denser, heavier bales in salvage operation. The benefits of applying shredding universally as a solution to volume reduction in waste handling is still to be proven. The material must still be compacted or baled after shredding and whether the volume reduction gain is worth the additional handling

A new future for baling

Seeking some answers to the future of baling as a weapon in the solid waste handling battle, MHE traveled to Chicago's Museum of Science and Industry and talked with Dr. Karl W. Wolf of the American Public Works Association. Dr. Wolf is completing work on a feasibility study of baling as a solution to many waste handling problems.

Over a period of 10 weeks, a series of tests were conducted which included the following: baling a large variety of refuse (without banding), shipping the same bales by railcar on six trips between Cleveland and Chicago, and subjecting unbanded bales to a rigorous series of 12 impact tests. It was Dr. Wolf's conclusion following the tests that baling is not only feasible, but also the beginning of a new technology.

According to Dr. Wolf, a useful bale must have two basic elements: adequate volume reduction and stability. The average bale can be reduced in volume about 8 to 1, but 15 to 1 is possible with certain materials. Working with a baler loaned to him by General Motors, Dr. Wolf found that the bales he was getting averaged in density about 60 lb. per cubic foot. This is better than with dry coal (35 lb. per cubic foot) or coal cinders (40 lb. per cubic foot).

Most of the tests were conducted with bales held together simply by compaction. In 95 percent of the cases this was sufficient. Only wet paper and corrugated failed to hold together. A few inexpensive steel or plastic bands easily strapped these materials into stable packages.

Unbanded bales were shipped back and forth between Cleveland and Chicago six times. This was a much greater distance than the trip to a landfill. In addition, impact tests were conducted at speeds of 5 and 10 mile per hour, both vertically and horizontally. Dr. Wolf was satisfied at the conclusion of these tests that most materials can be shipped to a distant landfill without the use of strapping.

One of the biggest advantages of baling, according to Dr. Wolf, could be realized at the landfill. Ordinary trash compacts to a density of about 1,000 lb. per cubic yard. A bale has a density of 1,600 lb. per cubic yard. Therefore, baling would increase the life of a landfill by 60 percent. Also, because of their dense nature, bales eliminate blowing papers, chance of fire, and penetration by rodents. Still another factor is the elimination of human error in compacting the sanitary landfill since the bales are already at full density.

Dr. Wolf was asked if baling, despite its advantages, could be done economically. He estimated the cost to be about 50 cents per bale. In terms of volume, one machine could bale over 500 tons of refuse in eight hours, producing a bale every 30 seconds with no problem. This would handle just about anybody's waste load.

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cost remains a question.

Baling, although centuries old as a method of handling bulk materials, is still a relatively new technology when applied to the solid waste field. Balers are being used in many plants across the country for packing larger volumes of salvageable waste, but their value as a universal tool for all types of refuse is still very much untested.

This may not be the case much longer. A number of studies are under way to determine the feasibility of refuse

baling. The City of San Diego's Public Works Dept. published an extensive report called "Baling Municipal Refuse" in April, 1968. Dr Karl W. Wolf of the American Public Works Association is completing a report on baling feasibility based on a series of rigorous tests conducted this summer. (See box on opposite page.)

In both cases baling was found to be not only feasible, but also to have a high probability of economic success.

The equipment illustrated on the next few pages could be a preview of future waste handling solutions.

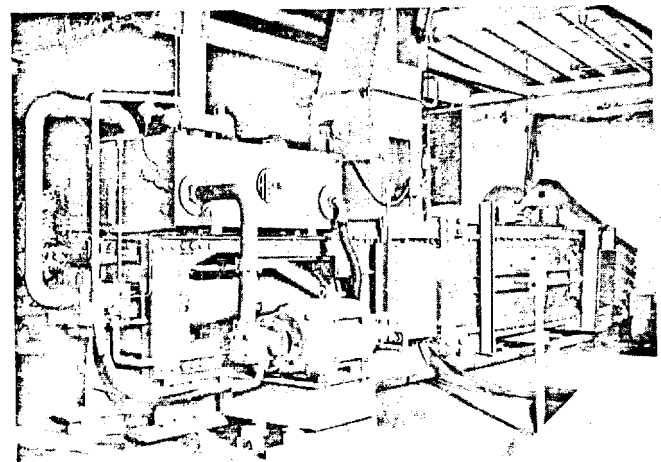
Extensive tests lead to development of new baler

A series of tests run by the American Baler Company, Bellevue, Ohio, in January, 1968, convinced them that baling solid waste is completely feasible and offers a high probability of economic success. This conclusion was backed by their decision to manufacture the Model 12375 baler.

To insure a true cross section of refuse material, the company brought in two different loads of trash from two diverse sections of a neighboring city. Both samples contained significant amounts of bottles, cans and plastic containers. The two loads were processed through a Williams Model 445 No-Knife Hog, loaded into a packer truck, and transported back to American Baler's Bellevue plant.

When the rubbish arrived it was fed into a standard, continuous, heavy-duty, horizontal baler. This baler was equipped with a larger main hydraulic cylinder so that tests could be run at greater pressures than normally used in collection of scrap paper. Plans were made to add water to the material, but this proved unnecessary since the moisture content of one sample taken at about the middle of the test was 30 percent.

After completing the tests and comparing the results and



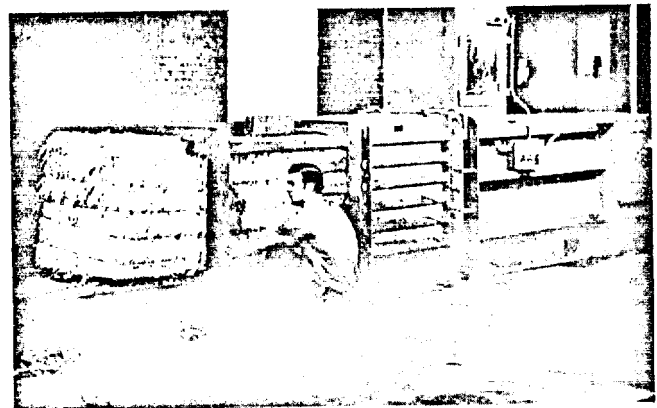
densities, American Baler went ahead with the Model 12375. This unit is guaranteed to produce 25 gross tons per hour on properly shredded materials run at a moisture rate of 30 percent. Density of the bales will run 65 to 70 p.c.f. with bale weights around 3,200 lb.

System lets the air do the walking

A record run of 93,000 books was recently set at the Chicago Book Manufacturing, Inc. This production record also generated tons of paper waste, but none of the usual scrap pile-up occurred. A Balemaster air scrap handling system with five separate localized fingers automatically gathered and baled the huge quantities of waste materials generated from the cutting and trimming machines. These were compressed into tight bales at a profit.

The company's baling requirements are 3 tons per hour. Two 3-ton-per-hour Balemasters from East Chicago Machine Tool Corp., handle this chore. If one part of the system breaks down, the balance operates unhindered. Machinery is never idle, never down unnecessarily.

Paper materials weigh very little individually, but in baled form they exceed the weight of boxboard or corrugated. If allowed to pile up near machinery space they could easily choke up production. Before installing the Balemaster system, manual baling methods tied up a good part of the shipping-receiving area. Bales were compressed by men jumping up and down on the paper. The dust problem alone



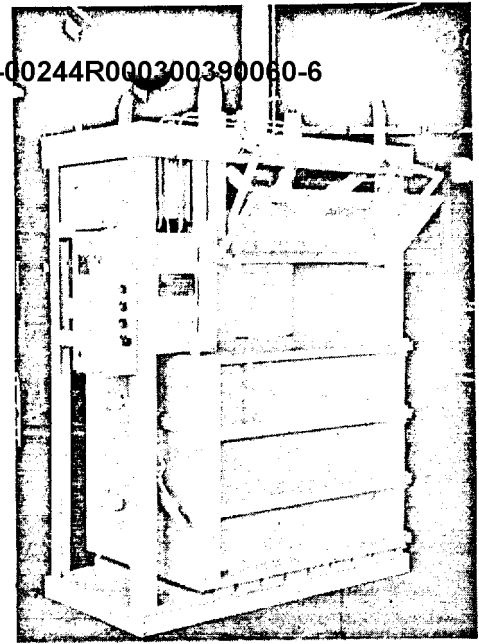
was murderous.

Now the new system with the air fingers handles 30,000 tons of paper scrap per week. Production time saved is between 15 and 20 percent with a savings of 50 man-hours per week in baling time. Machines run constantly with no time loss from production blockage.

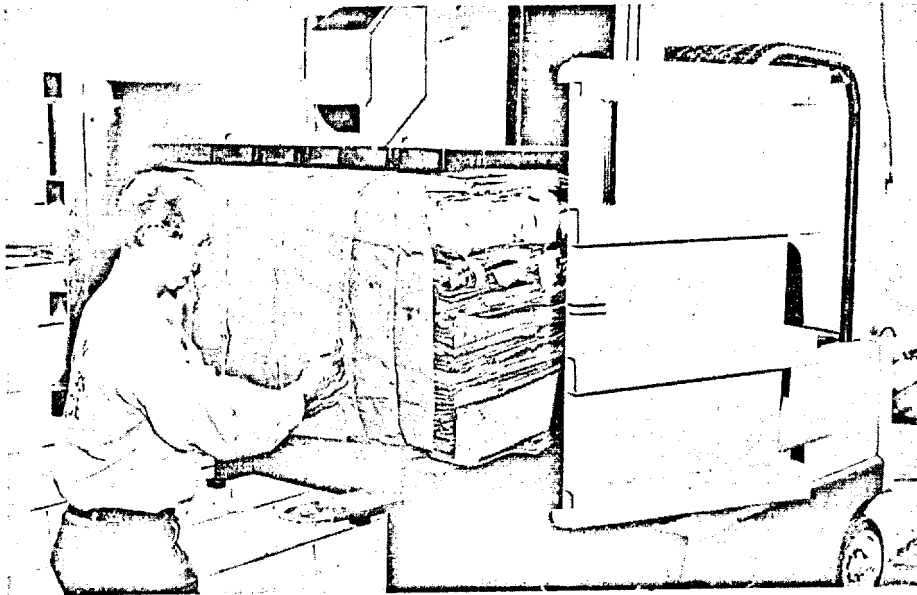
Downstroke baling press is great for waste paper

A wide variety of custom-made hydraulic downstroke baling presses are available from General Hydraulics of California, Inc. The Model 314 (shown here) is manufactured in three sizes: 48, 60, and 72 inches respectively, and can be purchased in either left or right hand versions to maximize loading efficiency.

Model 314 balers come with complete electrical systems, ready to operate, and need no regular maintenance. A single hydraulic plunger is the only machine element that moves. Anyone can operate the baler without special training. A simple control panel group with start-stop pushbuttons and directional valve lever saves steps and time while permitting hands off operation. Built-in safety interlocks and safety screen protect the operation under all conditions. An automatic motor shut-off shuts off the baler at the end of each stroke.



Portable baler compacts waste at the site



The Porta-Bale, from Western Lift Truck, Hayward, Calif., offers the user a truly portable baler that can be moved wherever needed. It compresses packing materials and manufacturing waste into compact bale form for convenient handling and disposal.

The Porta-Bale can be positioned at a receiving dock and its compression chamber used as a receptacle for corrugated cartons, strapping and packaging materials. Or, it can be located near operating equipment to be filled with punch-press skeletons, plastic die webs, newsprint or paper cuttings. This scrap is then compressed into bale form at the site without changing to another container. Usable floor space is increased.

Any standard fork lift will provide both compression power for the baling operation and transport the assembly. There is no permanent connection to lift, no coupling, no bolting. The lift truck is free at any time for other duties.

In practice, the chamber is filled and moved upwards until its contents are compressed against a fixed ram. The chamber is hinged on both sides and split at the center. This allows free access to pre-positioned baling tapes fitted with pull-tight buckles. The tape-secured bales can be readily removed and the chamber closed and secured for the next baling cycle.

The baling chamber is 41 by 26 by 36 inches, with larger

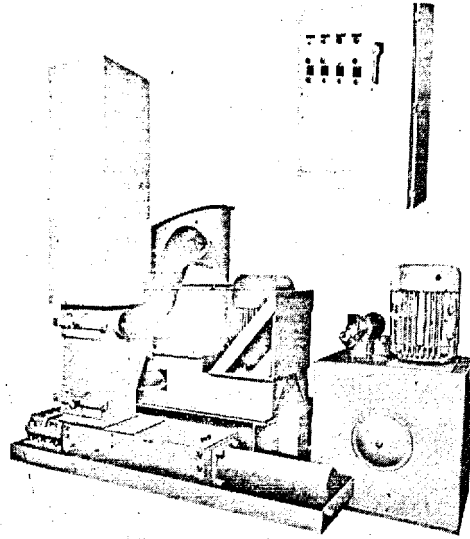
Pulverizer aids fight against air pollution

Mil-Pac Systems, Union, N.J., a unit of the SFM Corp., is taking an important role in the fight against air pollution with their solid waste disposal equipment.

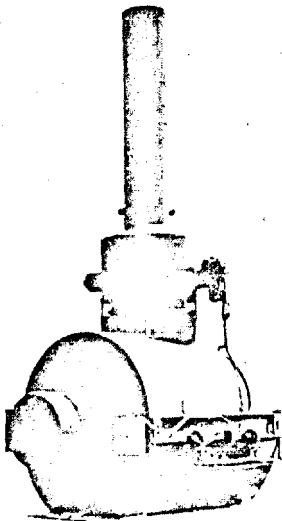
The system is proving ideal for high rise apartments, hospitals, industrial plants and other places where it is necessary to dispose of a high volume of solid waste efficiently and economically. It does not incinerate refuse. Instead, solid waste is fed into it manually or automatically. A hammermill grinder pulverizes the waste, be it paper, glass, metal cans or containers. The pulverized trash is then compacted into as little as 1/15th of its original volume in small easy-to-handle briquettes.

In addition, a modular design concept enables a Mil-Pac system to be installed in various configurations dictated by area size and shape.

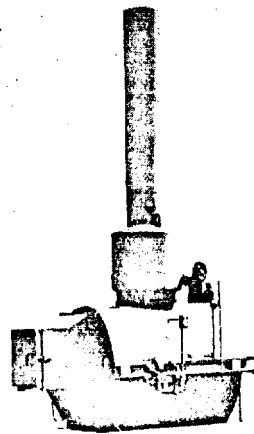
A dramatic use of the system is the mass destruction of classified, confidential material in industry and government. The system is available in a variety of models to suit most disposal requirements. Capacities range up to 7 cubic yards



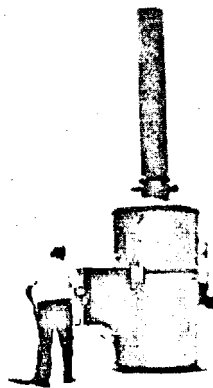
New incinerators meet anti-pollution laws



A35



A25



A20

A new line of easily packaged and economically installed combustion units meets or exceeds federal, state and local air pollution codes. It was introduced recently by Comtro Inc., a subsidiary of Stainless, Inc., North Wales, Pa.

The units were tested at the United States Testing Company, Inc., Hoboken, N.J., for particulate emissions. The findings showed the units to exceed all minimum requirements without the use of wet smoke scrubbing equipment.

The Comtro units provide a high efficiency of gas firing. Automatic controls insure safe,

simple operation of the unit. Waste material does not have to be separated prior to loading and is completely consumed without smoke, odor or fly ash. Most combustible items have a waste reduction ratio of 400 to 1.

The units range in size from the Model A20 with a capacity of 170 to 280 lb. per hour to the A39 with a capacity of 1260 to 1810 lb. per hour. Larger units are available on special order. A full line of automatic loading methods.

Solid waste incineration without air pollution

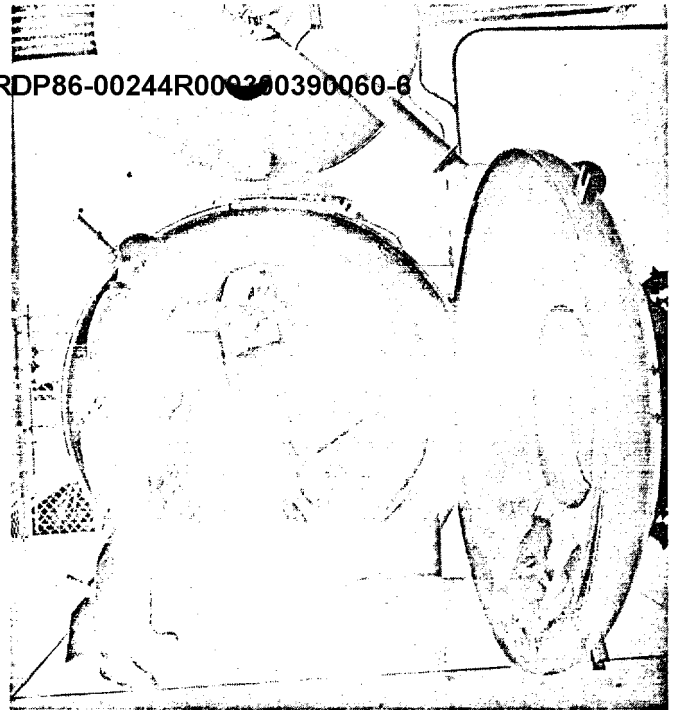
The Janitrol Aero Division of the Midland-Ross Corp., Columbus, Ohio, manufactures heat exchangers, pneumatic controls, aircraft combustion heaters, and other associated components for the aerospace market. And like other industrial installations, they generate a great deal of refuse. For a long time, hauling arrangements were handled by a private contractor who trucked the waste material to a nearby landfill. But, this system depended on human reliability, vagaries of the weather, and other imponderables.

Searching for a better method of disposal, Janitrol Aero settled on the Radicator incinerator manufactured by Midland Ross. By completely controlled air combustion, the Radicator unit transforms solid waste into irreducible ash content without air pollution—at low installation and operating costs.

The new unit has allowed Janitrol Aero to take a systems approach to handling its solid waste. Bags are placed at 65 stations inside the plant. Into these bags go tin cans, glass, assorted paper, corrugated, and other packing materials. Wood scraps from pallets and dunnage are collected on an exceptional basis.

On a regular schedule, a worker with a castor hand truck collects the bags and hauls them to the Radicator incinerator mounted in its own shed in the yard.

The Radicator includes a main chamber, an upper chamber, a forced air system, and a control package. All steps are automatic, including safety devices which protect the operator and the equipment. The operator need only work a 3-stage switch which provides for on, off, and automatic off. Trash may be loaded at any time except when a warning light turns on, indicating level temperatures. The



air curtain at the charging door protects the operator from blowback when loading during operation.

As an example of productivity on a single random day, the collection and burning of 83 bags converted 324-cubic-foot of trash into a little more than 1½ drums of irreducible ash content. The operator then cleans out the main chamber and stores the ash until a load accumulates.

Burnables with moisture content up to 35 percent are completely incinerated at 700 lb. per hour. No sorting of the trash is required beforehand. Glass melts into globules and tin cans oxidize into powder.

The unit is inexpensive to operate. The gas burner turns off at 1,500°F at which point the burning maintains itself. At 1,950°F an underfire air supply turns off, permitting an air curtain at the loading door and an overfire air supply to cool the system to protect the refractory material. If the temperature drops to 1,500°F the burner reignites.

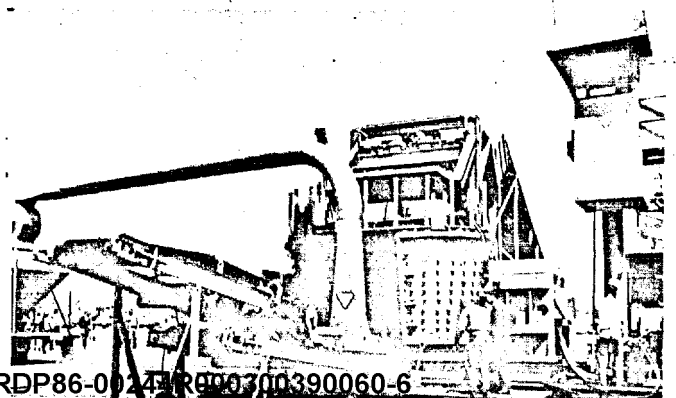
Twin-barrel shredder digests solid waste

After 6 years of development, Eidal International Corp., Albuquerque, New Mexico, is offering a new approach to the grinding process. The Model SW-200 shredder, featuring a vertical rotational movement combined with a self-compensating wear factor, results in a superior new system for reducing most materials to particle form.

The twin-barrel shredder grinds up solid waste at the rate of up to 80 tons per hour. Material which the machine digests includes whole refrigerators, trees, automobile bodies, over-stuffed furniture, tires, and other industrial or bulky refuse. Wherever extra large volumes of solid waste cause problems the SW-200 contributes significantly to the solution.

A wide conveyor system transports the refuse to the intake chute. Bulky material can be sized to flow freely into the shredder by means of a controlled feed. Once in the shredder, massive breaker bars break up the material, 24 heavy 16-inch diameter grinders tear it into smaller pieces,

and 96 grinding wheels, 12 inches in diameter, shred it into small particles. The end product is finely shredded, with no bulky pieces or voids.



Waste handling: Sanitary landfill is a current solution

The most practical method for the ultimate disposal of solid waste is the sanitary landfill. It provides an efficient way of disposing of refuse without the usual nuisance characteristics of a city dump or hazards to public health and safety. In a well-run sanitary landfill there are no unsightly rubbish piles. Refuse is dumped and immediately covered with earth. By using solid waste and garbage for fill, the land can be raised to the same level as if fill dirt were hauled into the area. Worthless swamp land and marshes can be turned into golf courses, parks, and even commercial property.

In principle, the sanitary landfill differs from the old style dump in an important way. Instead of indiscriminate dumping, refuse is confined to the smallest practical area, reduced in volume, and covered with a layer of earth at the conclusion of each day's operation. Confining and reducing the volume of the trash saves valuable landfill space and controls fires by reducing voids containing oxygen. Daily covering eliminates odors, blowing paper,

and fire hazards, and provides adequate control of insects and rodents. In addition, regulations require the erection of a high fence around the entire area. This prevents open access to the refuse site by the general public and keeps paper and other wind-blown debris within the confines of the landfill.

Meeting the requirements for daily compaction and cover represents the most difficult problem in any landfill operation. These functions must be performed in a consistent manner, day after day, regardless of weather and soil conditions. Proper compaction is extremely important if the area is to be used for future building construction.

This puts a heavy burden of responsibility in the machine which excavates the soil, spreads the refuse, and compacts the earth cover. Historically, the job has been handled by crawler tractors. But new machines are being introduced to meet varying soil and refuse conditions. The following illustrations are good examples of successful landfill equipment.

New compactor doubles the life of landfills

A new sanitary landfill compactor, the C451A, has been introduced by the Hyster Company's Construction Equipment Division. The C451A compacts refuse to twice the density of track-type tractors, squeezing more trash into a given area and extending the useful life of the landfill.

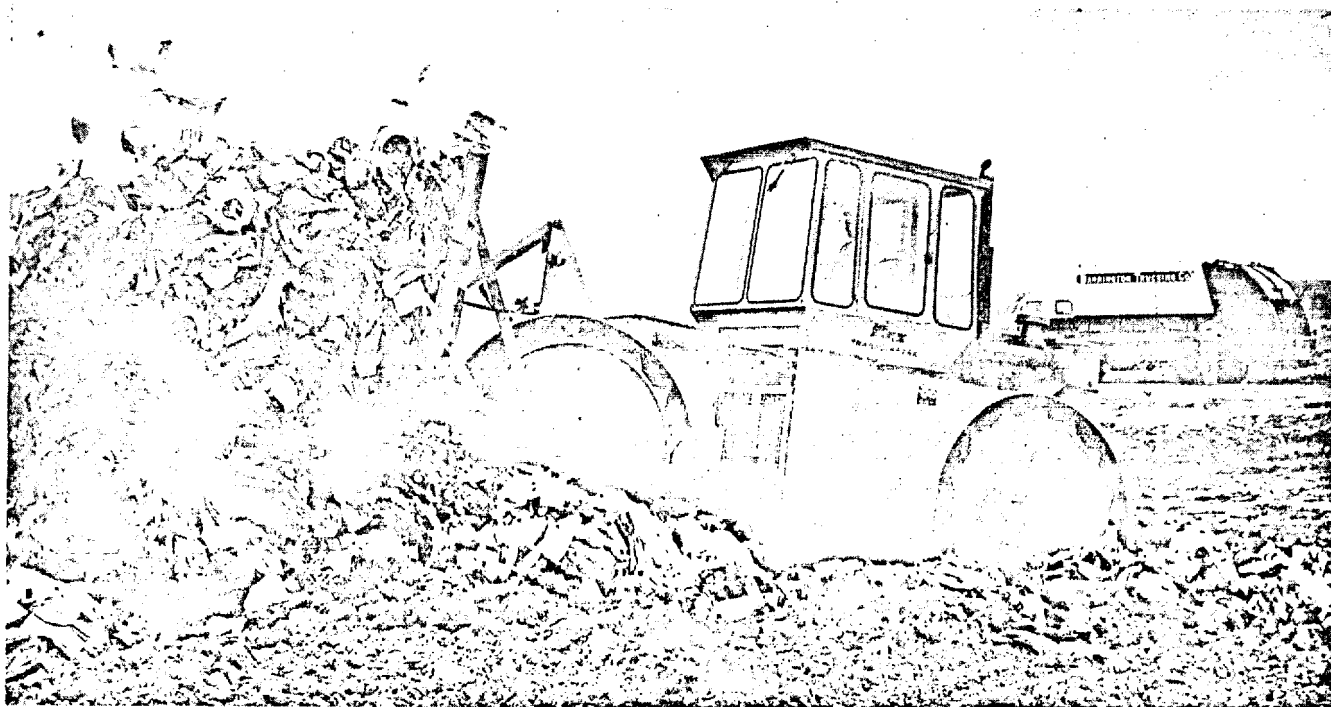
The compactor weighs 56,000 lb. and offers full width double compaction. Two compaction drums, each with a completely separate power unit and drive train, are connected by a universal-type hitch. The tamping feet are designed for efficient compaction of a wide variety of materials. These feet are capped with replaceable, heat-treated alloy steel pads for longer life.

Two Cat diesel engines supply the power through separate torque converter transmissions. Pusher-type fan and grills protect the engine compartment from excessive accumulation of refuse. A large overall drum diameter provides low rolling resistance and the ability to roll over and crush large objects. Two sets of spring cleaners on each drum keep wire and refuse from building up.

The blade is 12 feet wide and 6 feet, 8 inches high, and is designed for landfill operations. The upper portion is screened for better visibility.



All-purpose landfill machine delivers high density compression



The city of San Diego recently added a new machine to its sanitary landfill which they expect will save them as much as \$100,000 a year. The Trashmaster, manufactured by Rex Chainbelt, Inc., is a modern, specialized, all-purpose landfill machine that packs in more haul loads every day, and seals up tighter and cleaner at night.

"Bulldozers do a great job, particularly where pushing of dirt is required," said Robert R. Sayler, mechanical engineer for the Equipment Division of San Diego's Public Works Department. "But this machine, with its weight and three-wheel cleat action literally presses the stuff into the ground."

Four drum-type wheels, mounted in three-wheel configuration and filled with water ballast, carry wedge-action teeth which cut, grind, crush and compact everything from demolition to wet materials. Weighing 22 tons and traveling at speeds up to 12 m.p.h., the Trashmaster delivers a compressive impact force which eliminates gas pockets, destroys vermin breeding places, and reduces the depth of soil cover required for each lift. A 12-foot dozer with a pull-off hook easily handles and spreads full truck loads of refuse with single pass efficiency. Full power three-wheel drive and articulated steering give the Trashmaster outstanding performance on steep inclines and soft materials.

Elevating scraper speeds work at sanitary landfill

Baseball diamonds and picnic areas are now being developed on a 27-acre site that, until last fall, was a tremendous eyesore in the heart of Lucas County in Northern Ohio.

For 10 years, the site served as a burning dump and refuse disposal area for the town of Sylvania and surrounding communities. In just eight weeks last summer, Park Forest Development, Inc., of Toledo, a private company, covered the burning dump, landscaped the site, built roads, and returned the land to the county for recreational development.

Now the new sanitary landfill site is situated on a 104-acre tract of rolling, wooded terrain that for years has been classified as non-productive land because of its low elevation and bad drainage. Lucas County is not only getting rid of

its refuse more efficiently, but also is reclaiming much of this wasted land.

Park Forest Development's procedure is unusual. It employs an elevating scraper to dig trenches for refuse and to provide a clean earth cover over compacted waste. The scraper is an International E-200 self-loading machine that is more normally found on high-production construction projects.

On this job, the E-200 works hand-in-hand with an International TD-20B crawler tractor equipped with a special U-shaped bulldozer blade that can move mountains of refuse on each pass.

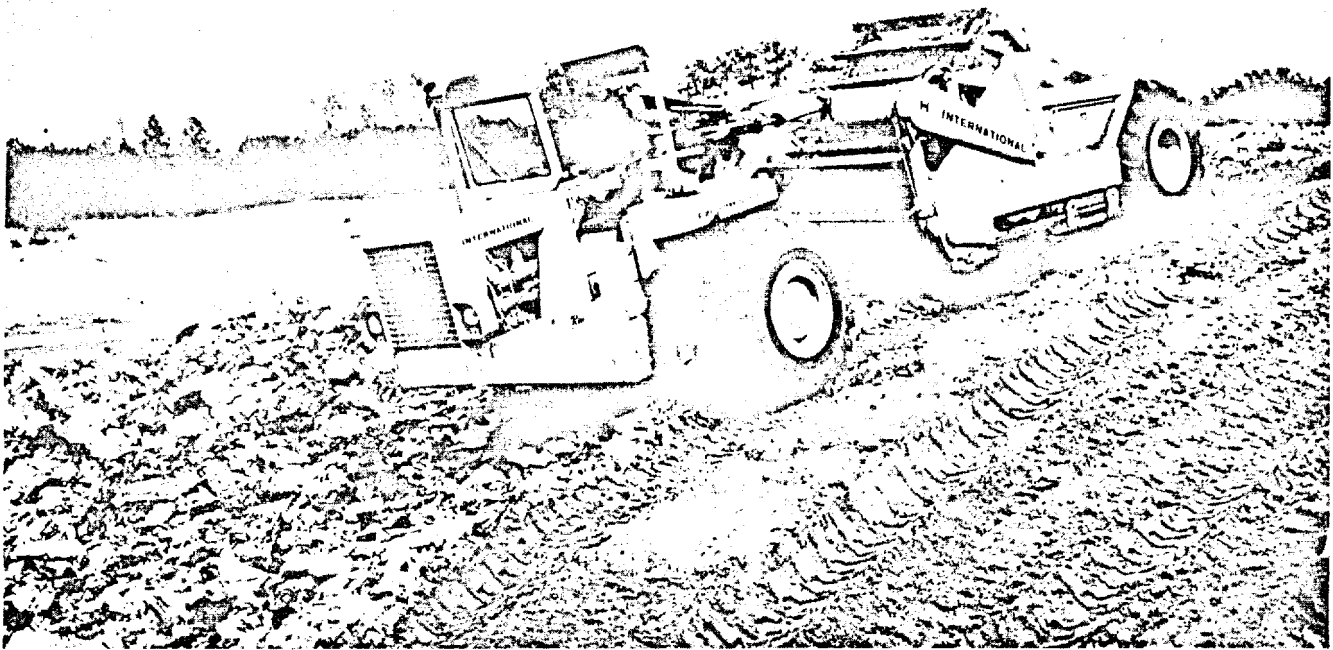
The Payscraper's first duty is to excavate a trench—

usually about 120' **Approved For Release 2002/05/07 : CIA-RDP86-00244R000300390060-6**
As refuse trucks dump their loads at the side of the trench,
the material is spread and compacted by the 40,000-pound
crawler tractor.

Then the elevating scraper excavates material from
another trench section and spreads a six-inch cover of clean
earth over the refuse. When a section is completely filled
with waste, the E-200 spreads a two-foot-thick layer of

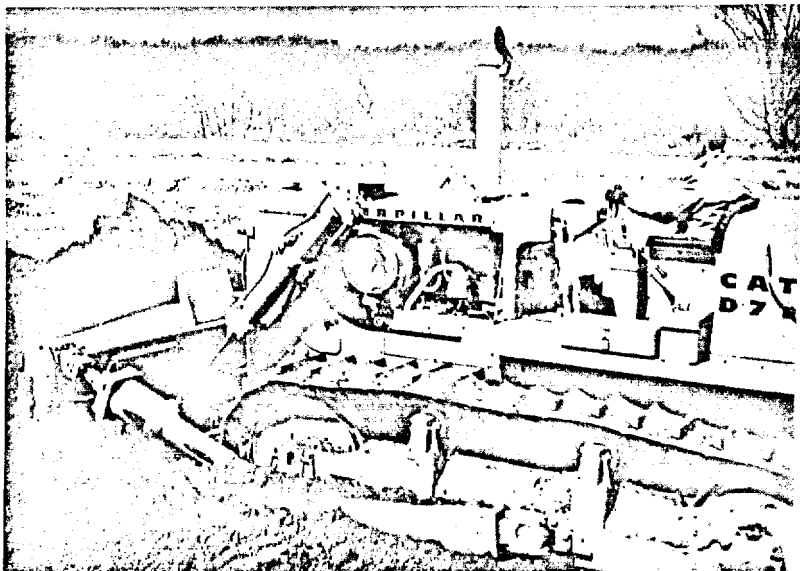
Approved For Release 2002/05/07 : CIA-RDP86-00244R000300390060-6 an average of
300 cubic yards a day and can spread that quantity as cover
in about two hours. This enables the contractor to control
the dumping procedure so that refuse is never left uncovered
for extended periods.

The Payscraper can also spread cover more evenly than
a tractor. Its apron can be controlled to spread a nine-yard
payload of material to within an inch of the desired grade,
and it covers without disturbing the compacted refuse.

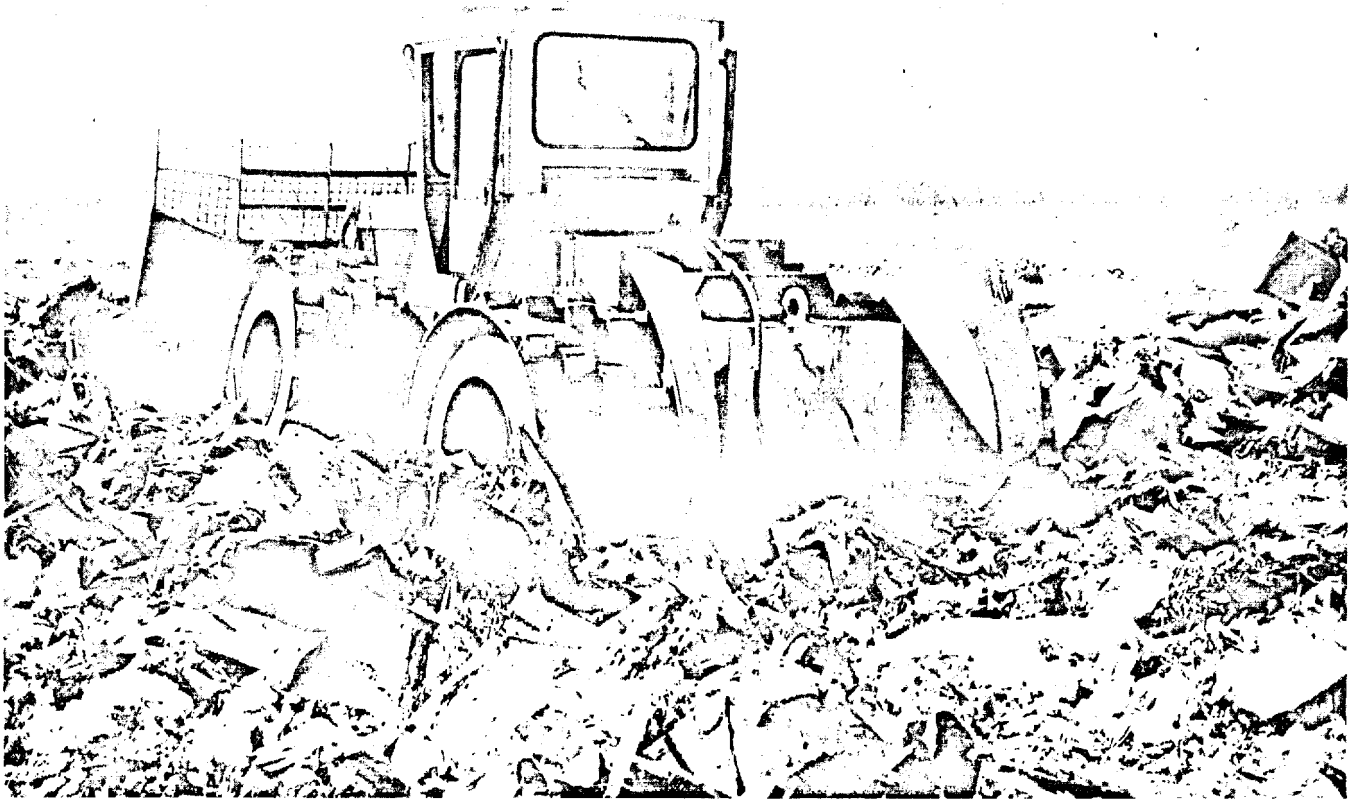


Track-type tractors are great for landfills

Caterpillar tractors such as the D7E shown here have been
providing landfill service for many years. The wide-spread
weight of the crawlers makes them well-suited for use in
swamps and marshes where rubber-tire tractors could bog
down. They are commonly applied in landfill projects to
take advantage of their excellent digging and spreading
capacities. All models feature fast, positive hydraulics and
on-the-go power shift. Direct drive is available on all models
except the D9G.



Special compactor aids landfill conversion



Gary, Indiana, a heavy industrial area, found itself literally knee-deep in the by-products of its location. Not only do the industries and the 178,000 inhabitants use Gary's dumping facilities, but so do many of the surrounding communities. The volume exceeds 10,000 tons of rubbish per day.

New ideas on how to best handle the refuse problem were pursued. After viewing the successful landfill operations of other cities, Gary decided to convert its open dump. Funds were set aside for the project and conversion of the old dump was begun.

Gary already owned two crawler tractors but slow performance and the need for greater compactibility forced them to look for another machine. They decided on a Michigan CS 70 Trash Pak compactor, a steel-wheel com-

paction tractor specially designed by Clark Equipment Co. for sanitary landfill operations.

Rolling on special cleated steel wheels, the 24,000-lb. Trash Pak exerts a crushing 1,061 pounds of pressure per lineal inch, more than enough to smash most appliances and rubbish. Articulated steering gives it maximum maneuverability.

As the trucks dump their loads, the compactor spreads the refuse with its 9½-foot-wide blade. At the same time, the 54- by 23-inch wheels are compacting. This combination keeps blowing refuse to a minimum and gives incoming trucks a smoother, less dangerous road bed.

To complete the landfill process, a Caterpillar D6 tractor crawler spreads sand over the compacted areas.

The waste handling and processing equipment and systems featured on the preceding 19 pages are described in detail in free brochures and catalogs.

See page 152 for a listing

of the free literature available . . .

STEVE

Thought you may be interested
in this ARTICLE. pls return
to me on Thursday 26 Sept.
Thanks.

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1. No solutions for disposal of residue
 2. No "Thoughts" as to the use of by-products
such as heat, steam etc
- W