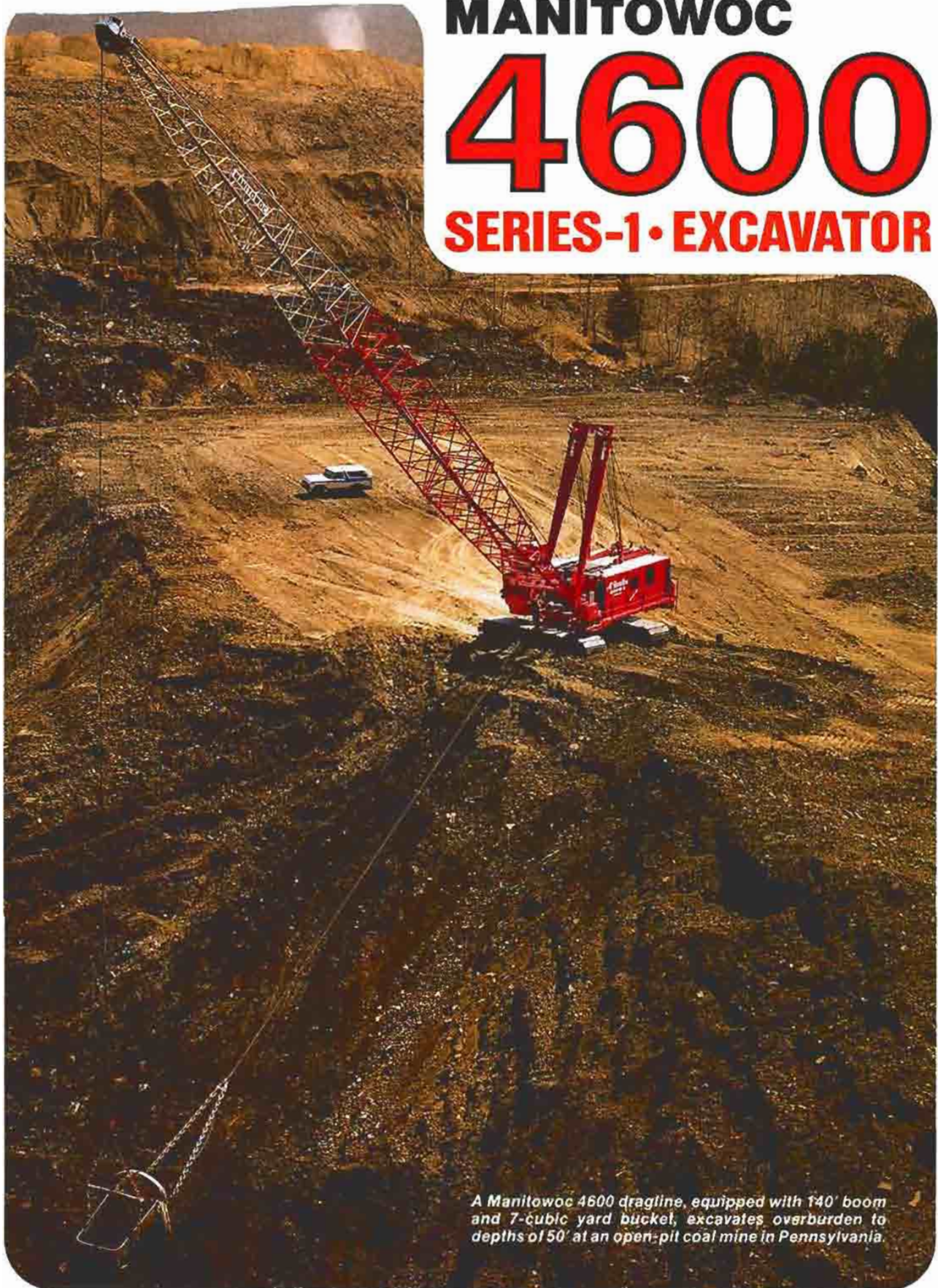


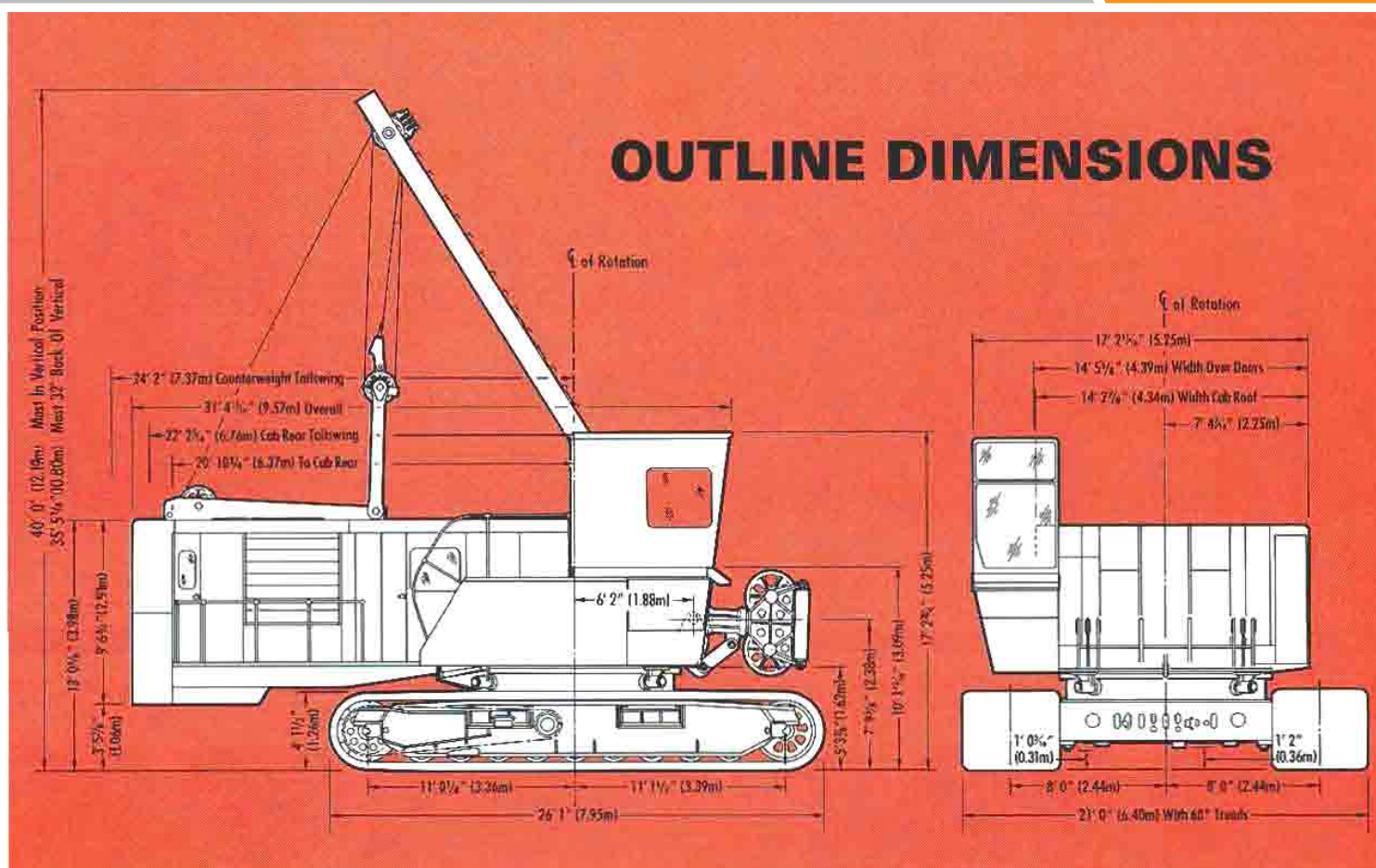
MANITOWOC

4600

SERIES-1 • EXCAVATOR



A Manitowoc 4600 dragline, equipped with 140' boom and 7-cubic yard bucket, excavates overburden to depths of 50' at an open-pit coal mine in Pennsylvania.



WEIGHTS

| | Pounds* |
|--|---------|
| DRAGLINE (complete): lowerworks, upperworks, and 100' basic boom | 389,555 |
| CLAMSHELL (complete): lowerworks, upperworks, and 100' basic boom | 428,905 |

LOWERWORKS:

| | |
|--|---------|
| Carbody , with travel mechanism, king pin, and roller path | 54,075 |
| Crawler Assemblies (2) , with 60" wide treads and outside drive chains (each assembly 52,940) | 105,880 |

UPPERWORKS:

| | |
|---|---------|
| Rotating Bed , complete with basic machinery, including drums, but not front end attachments or counterweights | 147,785 |
| Mast and Backhitch: | |
| Dragline | 10,995 |
| Clamshell | 16,120 |
| Removable Counterweights (Dragline): | |
| 100' Boom (3-piece) 37,000; 9,500; 9,500 | 56,000 |
| 120' Boom (4-piece) 37,000; 9,500; 9,500; 10,000 | 66,000 |
| 140' Boom (4-piece) 37,000; 9,500; 9,500; 32,000 | 88,000 |

| | Pounds* |
|--|---------|
| Removable Counterweights (Clamshell): | |
| 100', 120', and 140' Boom (4-piece) 37,000; 9,500; 9,500; 32,000 | 88,000 |
| Dragline Fairlead (revolving type) | 3,915 |
| Tagline | 1,280 |

BOOM NO. 40:

| | |
|--|-------|
| Butt: | |
| Dragline | 7,590 |
| Clamshell | 8,710 |
| Top: | |
| With single-sheave point assembly | 5,050 |
| With double-sheave point assembly | 5,610 |
| Inserts: | |
| 20' Tapered (less pendants) | 2,020 |
| 20' (less pendants) | 2,560 |
| 40' (less pendants) | 4,895 |
| Single-Length Pendants (sets of 4): | |
| 100' Boom | 1,940 |
| 120' Boom | 2,240 |
| 140' Boom | 2,520 |

*Weights are approximate and may vary between machines as a result of design changes and component variations.

POWER PLANTS

| BASIC | Model | Cylinder | Bore | Stroke | Cubic Inch Displacement | Net HP @ RPM (at flywheel) | Converter | Function |
|----------|---|----------|--------|--------|-------------------------|----------------------------|--------------|-----------------------|
| OPTIONAL | Cummins KTA-1150-C525 | 6 | 6.250" | 6.250" | 1,150 | 431 @ 2,000 | 3 Stage | Hoist |
| | Cummins N-855-C235 | 6 | 5.500" | 6.000" | 855 | 215 @ 1,800 | 3 Stage | Swing & Travel |
| | Detroit Diesel 12V-71N | 12 | 4.250" | 5.000" | 852 | 393 @ 2,000 | 3 Stage | Hoist |
| | Detroit Diesel 6-71N | 6 | 4.250" | 5.000" | 426 | 195 @ 1,800 | 3 Stage | Swing & Travel |
| | Cummins VTA-1710-C700 | 12 | 5.500" | 6.000" | 1,710 | 685* @ 2,000 | 2 Controlled | Hoist, Swing & Travel |
| | Detroit Diesel 12V-71N | 12 | 4.250" | 5.000" | 852 | 393 @ 2,000 | Controlled | Hoist |
| | Detroit Diesel 8V-71N | 8 | 4.250" | 5.000" | 568 | 272 @ 1,800 | Controlled | Swing & Travel |
| | Caterpillar D-379 | 8 | 6.250" | 8.000" | 1,964 | 635* @ 1,270 | 2 Controlled | Hoist, Swing & Travel |
| | Caterpillar 3412 DIT Dual Turbo | 12 | 5.400" | 6.000" | 1,649 | 630* @ 2,000 | 2 Controlled | Hoist, Swing & Travel |
| | Fuel Tank Capacity: 910 Gallons. *Rating Without Fan. Electric Power Available—Consult Factory. | | | | | | | |

DRUMS AND LAGGINGS

| Application | Drum | Diameter | Drum Width | Type of Drum or Lagging | Wire Rope Size | Single Layer Spooling Capacity 1st Layer Only |
|--|-------|----------|------------|-------------------------|----------------|---|
| CLAMSHELL Closing Holding | Rear | 34½" | 30" | Grooved Drum | 1¾" | 165' |
| | Front | 34½" | 30" | Grooved Drum | 1¾" | 165' |
| DRAGLINE Drag Hoist Drag (Optional) | Rear | 38" | 30" | Grooved Drum | 1¾" | 153' |
| | Front | 38" | 30" | Grooved Drum | 1¾" | 184' |
| | Rear | 38" | 30" | Grooved Drum | 1¾" | 144' |
| CLAM TO DRAG CONVERSION Drag Hoist Drag (Optional) | Rear | 41" | 30" | Grooved Lagging | 1¾" | 167' |
| | Front | 41" | 30" | Grooved Lagging | 1¾" | 201' |
| | Rear | 41" | 30" | Grooved Lagging | 1¾" | 157' |

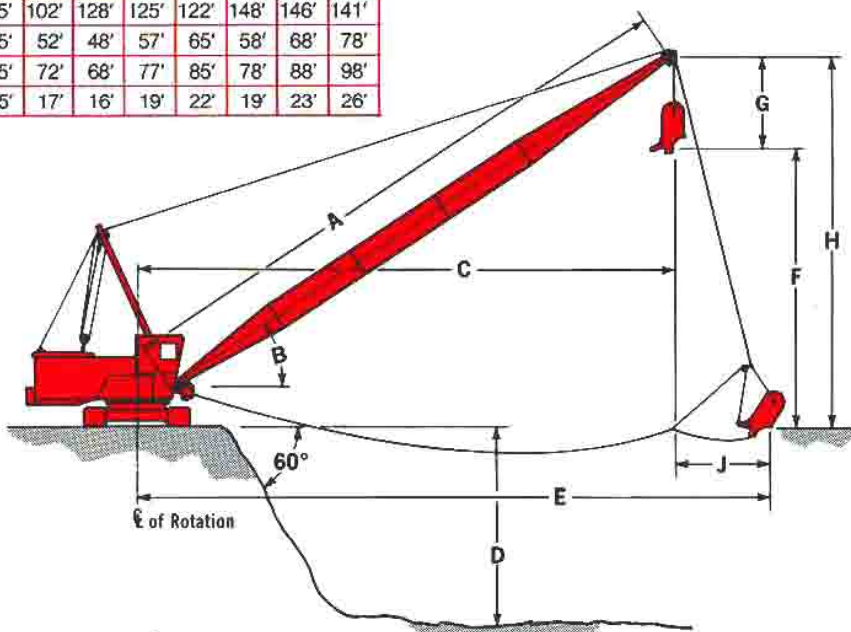
DRAGLINE RANGE DIAGRAM

38" DRUMS WITH 1¾" DRAG ROPE

| A | Boom Length | 100' | | | 120' | | | 140' | | |
|---|----------------------------------|------|------|------|------|------|------|------|------|------|
| B | Boom Angle | 30° | 35° | 40° | 30° | 35° | 40° | 30° | 35° | 40° |
| C | CL of Rot. to Ctr. Dump | 95' | 90' | 85' | 112' | 106' | 100' | 129' | 123' | 115' |
| D | Depth Cut (Approx.) | 87' | 82' | 75' | 113' | 104' | 96' | 103' | 93' | 83' |
| E | Digging Reach (Approx.) | 108' | 105' | 102' | 128' | 125' | 122' | 148' | 146' | 141' |
| F | Dumping Height | 38' | 45' | 52' | 48' | 57' | 65' | 58' | 68' | 78' |
| H | Ht. from Grade to CL of Boom Pt. | 58' | 65' | 72' | 68' | 77' | 85' | 78' | 88' | 98' |
| J | Casting Distance | 13' | 15' | 17' | 16' | 19' | 22' | 19' | 23' | 26' |

The working ranges in the table above are based on the following conditions:

1. Dimension 'F' is based on 'G' dimension of 20'.
2. Dimension 'D' is based on a 16' floor level bottom to fill the bucket and casting distance 'J' equal to approximately 1/3 the dumping height 'F'. The two dimensions are also based on maximum drum capacity with one layer of rope. Front drum (hoist) capacity —184' of 1¾" diameter rope —Drum No. 48142. Rear drum (drag) capacity —153' of 1¾" diameter rope —Drum No. 48143. The depth of cut, casting distance and digging reach may vary considerably depending on digging conditions, design of bucket and operator's skill. Maximum digging depths are attainable under ideal conditions and cannot be guaranteed.
3. New machines equipped with wire rope to dig to a depth of 60', 70' and 80' for boom lengths of 100', 120' and 140' respectively.

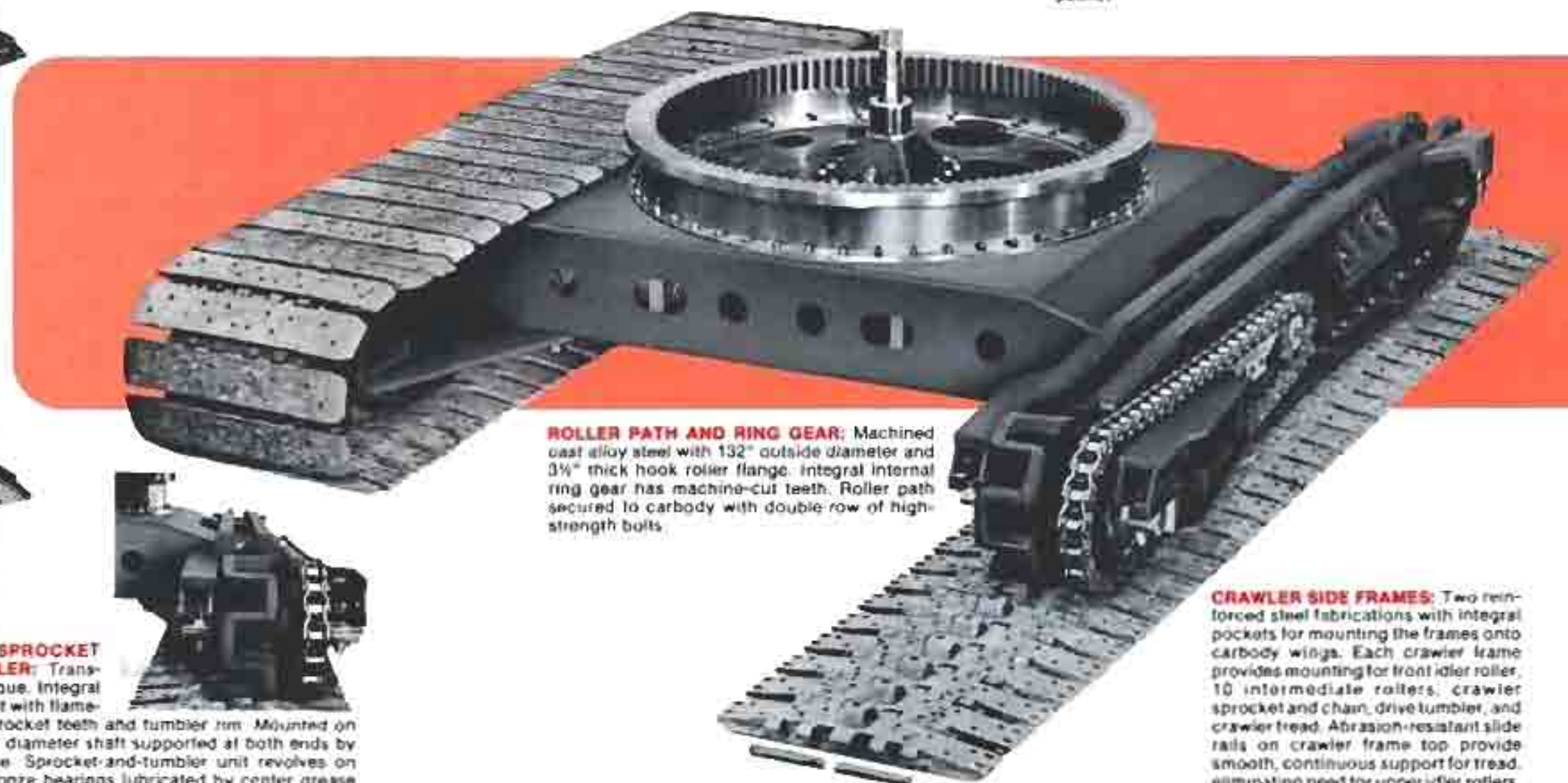


LOWERWORKS



CARBODY: Single-piece, ribbed steel fabrication with integral side wings that transmit loads directly to crawler frames. Fabricated construction provides high strength-to-weight ratio. Carbody design transmits loads evenly from area beneath roller path to wings.

Finished carbody with welded bottom plate (below) shows machined wing surfaces that mate with integral pockets in crawler frames, providing rugged mounting and a low center of gravity.



ROLLER PATH AND RING GEAR: Machined cast alloy steel with 132" outside diameter and 3 1/4" thick hook roller flange. Integral internal ring gear has machine-cut teeth. Roller path secured to carbody with double row of high-strength bolts.

CRAWLER SIDE FRAMES: Two reinforced steel fabrications with integral pockets for mounting the frames onto carbody wings. Each crawler frame provides mounting for front idler roller, 10 intermediate rollers, crawler sprocket and chain, drive tumbler, and crawler tread. Abrasion-resistant slide rails on crawler frame top provide smooth, continuous support for tread, eliminating need for upper idler rollers.

CRAWLER DRIVE: Drive chain located on outside of each crawler frame. Drive sprocket self-contained within crawler frame and joined to horizontal travel shaft by jaw clutch coupling. Design allows crawler removal without separating drive chain or tread.

TREAD ADJUSTMENT: Crawler tread easily adjusted by positioning front idler roller shaft with hydraulic jack, then inserting U-shaped shims to hold shaft in place.



TRAVEL AND STEERING MECHANISM: Power transmitted from upperworks through vertical travel shaft to three-piece horizontal travel shaft, shown with covers removed. Bevel gears run in oil. Combination steering clutch-and-lock located on each side of bevel gears. Ratchet wheel for travel locks on right side. Reduction gears on each end of shaft increase torque to crawlers. Steering provided by spring-loaded, air-controlled steering clutch-and-lock mechanisms. Both clutches engaged for straight travel, one clutch placed in neutral or locked position for gradual or sharp turns. Interlock keeps one clutch engaged at all times. Travel locks are air operated, have dual ratchet arrangement, permitting travel in one direction while preventing movement in other. Can be set to prevent travel in both directions.

CRAWLER SPROCKET AND TUMBLER: Transmit drive torque. Integral cast steel unit with flame-hardened sprocket teeth and tumbler rim. Mounted on stationary 7" diameter shaft supported at both ends by crawler frame. Sprocket-and-tumbler unit revolves on two large bronze bearings lubricated by center grease pocket. Self-cleaning tumbler has alternate sides open. Drive chain adjusted by positioning shaft with hydraulic jack, then inserting U-shaped shims to hold shaft in place.

CRAWLER TREADS: 60" wide, 52 pads per crawler frame. Adjacent pads connected by two high-carbon steel pins. Pads' closed design prevents them from carrying dirt up onto crawler frames.

INTERMEDIATE ROLLERS: Double-flanged, 20" diameter rollers, bronze bearing mounted on 8" diameter stationary shafts. Rollers are located in pockets along underside of crawler frame.



CRAWLER PADS: Constructed of cast alloy steel in a closed box-section design with center driving lug. Heavy internal ribbing provides great pad strength, especially next to driving lug, where intermediate rollers bear. Pad bottom edges taper upward to minimize digging in during turns.

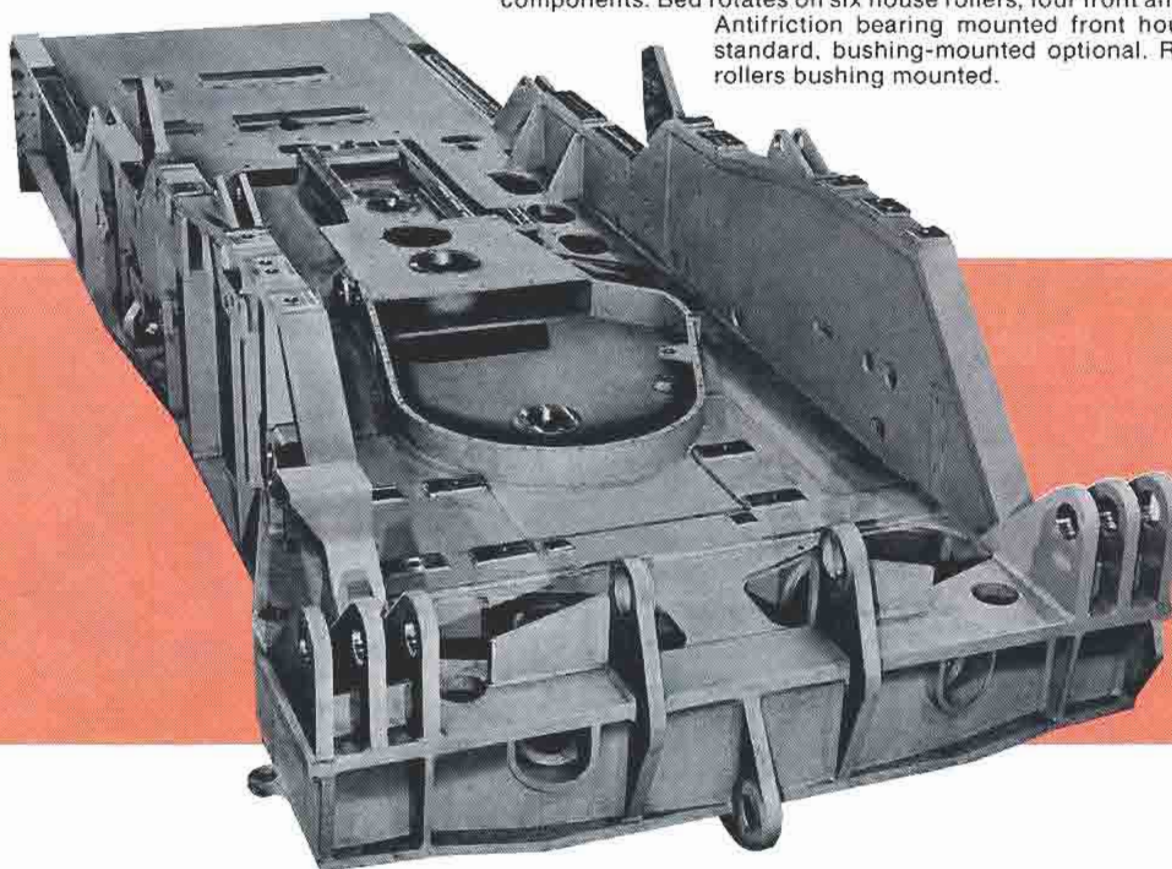


UPPERWORKS



REAR HOOK ROLLERS: Four bushing-mounted rollers supported in pairs by heavy steel hangers that pivot to equalize roller loads. Rollers are mounted on eccentric shafts for easy adjustment.

ROTATING BED: Single-piece, welded steel fabrication with integral machinery side frames. Provides rigid deck for mounting all upper-works components. Fabricated construction provides high strength-to-weight ratio. Precision boring assures proper alignment of machinery components. Bed rotates on six house rollers, four front and two rear. Antifriction bearing mounted front house rollers standard, bushing-mounted optional. Rear house rollers bushing mounted.



FRONT HOOK ROLLERS: Two bushing-mounted rollers supported individually by heavy fabricated steel hangers bolted to underside of rotating bed. Rollers are mounted on eccentric shafts for easy adjustment.

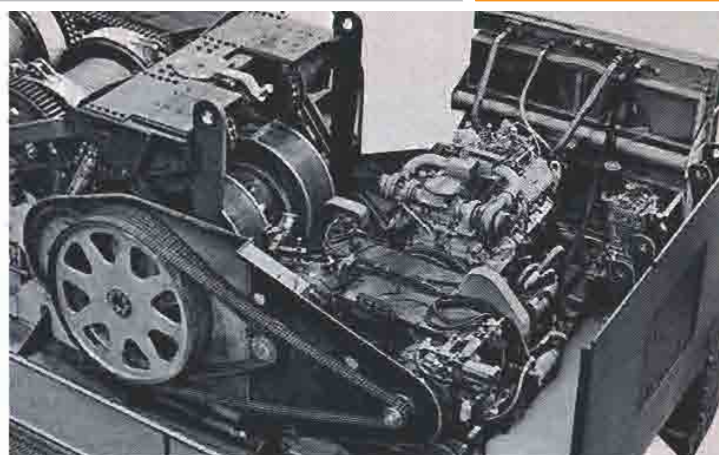


SWING LOCK: Air-controlled, spring-set, gear-type lock meshes with swing gear for positive locking.



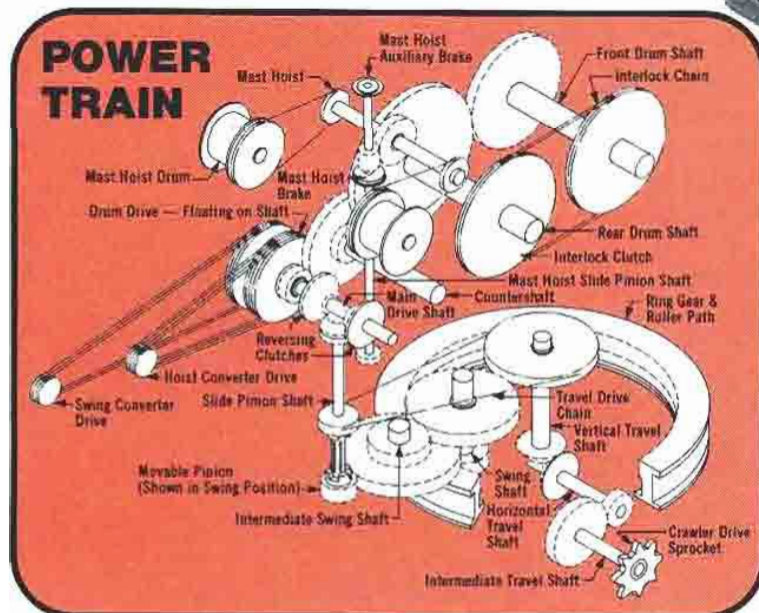
SINGLE ENGINE: Optional. One diesel engine driving through a transmission case to two VICON® controlled torque converters. Front converter powers main drums. Rear converter powers main drive shaft for swing, travel, and mast hoist. Variable speed and torque achieved by converter sleeve valves, without slipping clutches and brakes.

DUAL ENGINES: Standard. Two diesel engines, each driving a three-stage torque converter. Front engine powers main drums. Rear engine powers main drive shaft for swing, travel, and mast hoist. Variable speed and torque achieved by engine throttles, without slipping clutches and brakes.



ENGINE SERVICE AREA: Ample space around engines permits easy access for maintenance and service.

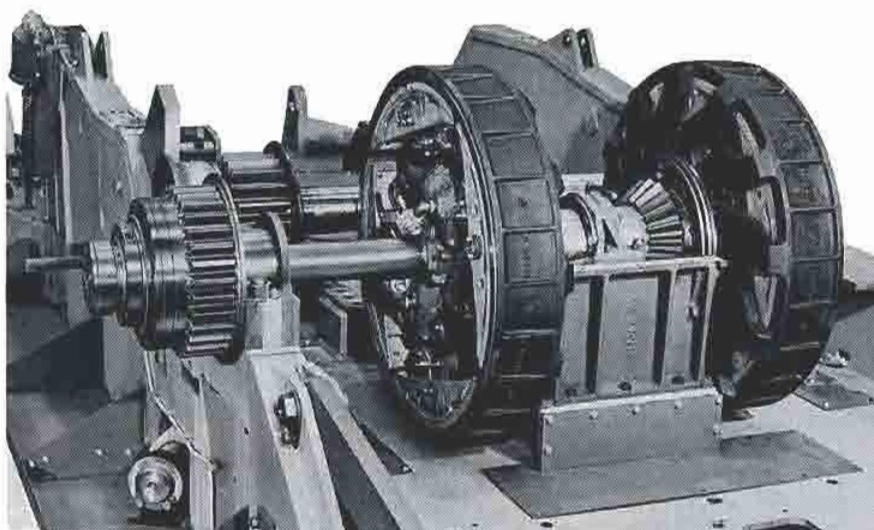
DRUM DRIVE: Front converter chain-drives sprocket-and-pinion combination floating on main drive shaft. Pinion transmits power to countershaft gear and pinion, which drive rear drum shaft. Rear drum shaft powers front drum shaft by gear drive. A 99-tooth rear drum gear and 66-tooth front drum gear are standard, with 99-tooth front drum gear optional. All drive chains and gears are fully enclosed and oil lubricated.



CENTRALIZED LUBRICATION: Grouped grease fittings placed in easily accessible areas simplify lubrication and reduce maintenance time.



POWER TRANSMISSION, VICON®: The patented VICON (Variable Independent CONTROL) system provides stepless variable power transmission for major machine functions. Clutches are engaged when little or no torque is transmitted from the power source, virtually eliminating clutch slippage and wear. After clutch is set, engine RPM or controlled torque converter output is increased to provide infinitely variable speed or torque.

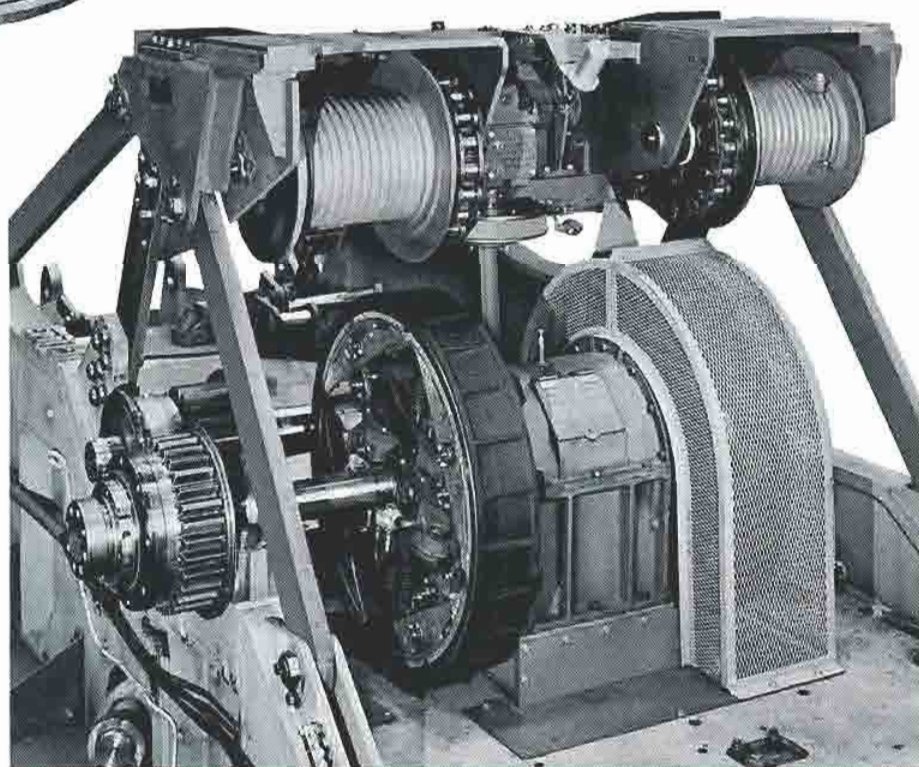


MAIN DRIVE SHAFT: Antifriction-bearing-mounted, alloy steel shaft chain-driven by rear converter. Powers large reversing clutches that control direction of swing, travel, and mast hoist. Reversing clutches air-controlled, internal-expanding, shoe-type with four individual aluminum shoes each. Steel clutch spiders splined to shaft. Cast alloy iron clutch drums and steel bevel pinions antifriction bearing mounted. Bevel pinions and bevel gear are oil lubricated. Also mounted on main drive shaft is a floating sprocket-and-pinion combination that is chain-driven by front converter and transmits power to drum drive gears. All chain and gear drives are enclosed and oil lubricated.

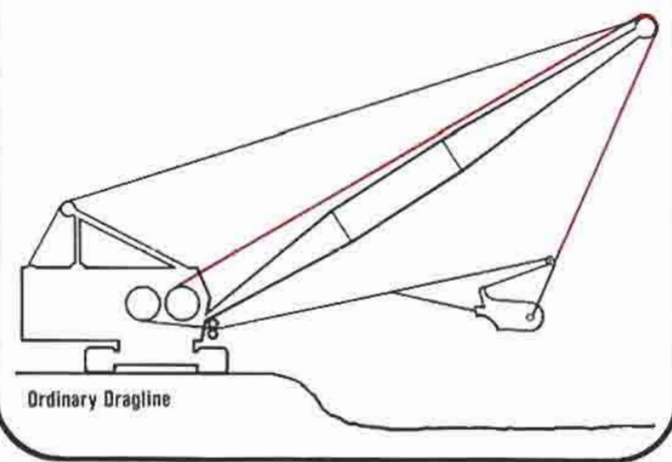
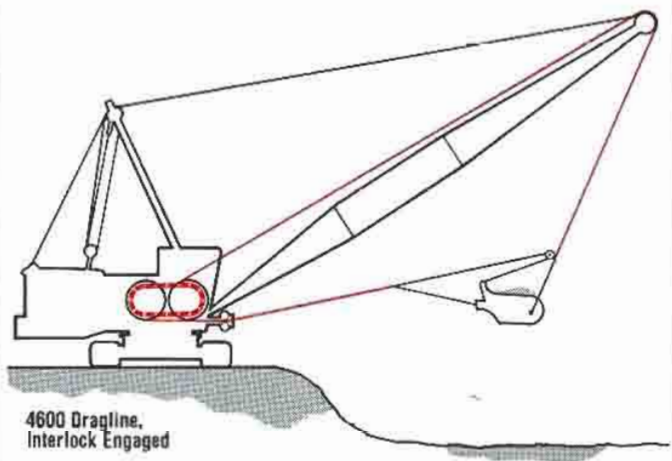
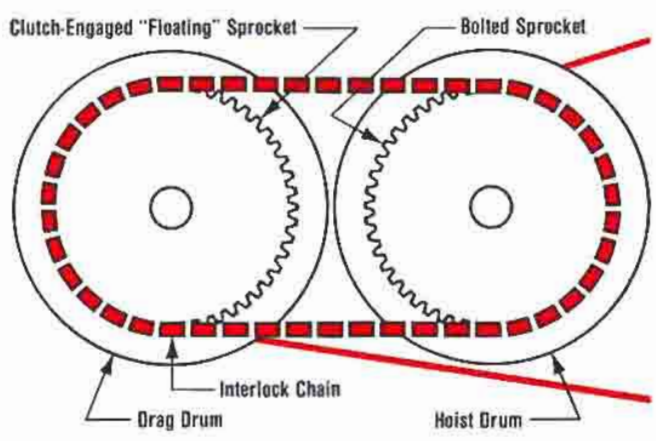


SWING AND TRAVEL SLIDE PINION SHAFT: Alloy steel shaft, antifriction bearing mounted. Bevel gear splined to upper end is powered by bevel pinions on main drive shaft reversing clutches. Slide pinion positioned manually to select travel or standard swing. When slide pinion is engaged for travel, power is transmitted by chain to vertical travel shaft running down through king pin to horizontal travel shaft in carbody. When slide pinion is engaged for swing, high-cycle performance is provided by main drive shaft reversing clutches. Large drum brake mounted on lower end of shaft provides braking for swing.

MAST HOIST: Used only for positioning moving mast to hold boom at selected angle, not for operating under load. Mast hoist engaged by air-operated slide pinion that transmits power from main drive shaft. Not independent of travel and standard swing functions. Power is transmitted through mast hoist slide pinion shaft to second shaft that chain-drives drums. Dual wire rope drums provide equal tension on both sides of mast rigging. Spring-applied, air-released brake; disc-type auxiliary brake; and automatic mast hoist kick-out are provided.

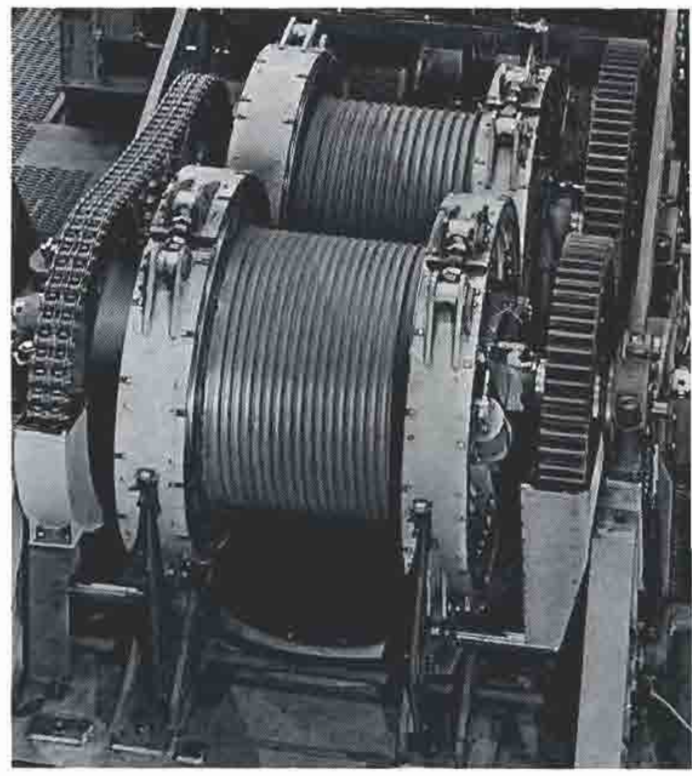


DRAGLINE INTERLOCK: Eliminates drag and hoist brake riding. Interlock chain connects sprocket floating on drag drum shaft with a sprocket bolted to hoist drum. Floating sprocket is selectively engaged to drag drum by an operator-controlled clutch. With clutch applied, interlock synchronizes speed and direction of drag and hoist drum rotation. Drag rope pays out at same rate hoist rope spools in. Drag rope remains taut, bucket stays level, drag brake riding is eliminated. In addition, bucket tension on drag rope is transmitted through interlock to hoist drum, reducing required hoist power and fuel consumption. Interlock also enables simultaneous lowering and in-hauling of bucket, without hoist brake riding. Clutch may be disengaged at any time to cast.

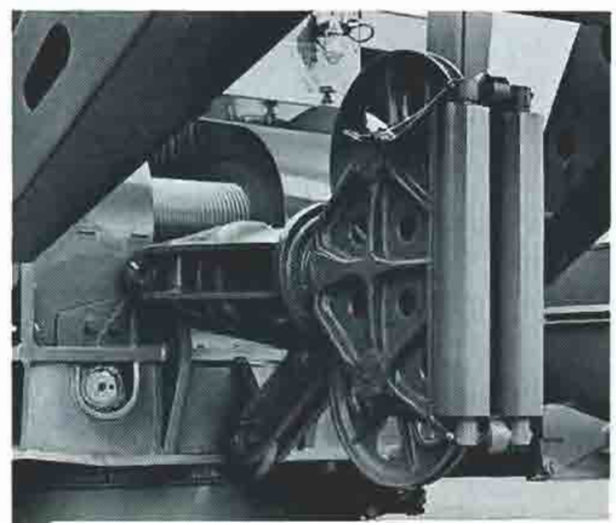


FRONT AND REAR DRUM ASSEMBLIES: Both drum shafts are heat-treated alloy steel and have antifriction bearing mountings. Main drum gears have steel hubs and replaceable rims. Drum gear hubs and clutch spiders are integral and keyed to drum shafts. Drums are antifriction bearing mounted on shafts. Both drums are grooved steel with a cast iron combination brake-and-clutch flange bolted to each side. Drum clutches are air-controlled, internal-expanding, band-type with heavy-duty molded linings. Dual brakes are external-contracting, band-type. They are air-applied during operation, spring-set for parking, and automatically applied if air pressure is lost. Electric fans provide constant flow of air to cool clutch and brake surfaces.

Front drum used for holding line on clamshell or hoist on dragline. Rear drum used for closing line on clamshell or drag on dragline. When machine is equipped for dragline service, rear drum has clutch and sprocket for dragline interlock.



FAIRLEAD: Full-revolving, antifriction bearing mounted in support at front of rotating bed. Equipped with two 32" diameter sheaves and two large guide rollers.



FRONT END EQUIPMENT

NO. 40 BOOM: 40' butt, 20' and 40' inserts, 40' top. Rectangular box-section design. All-welded steel construction with inverted-angle chords and tubular lacings. Chords are 100,000 PSI yield steel. Butt, 20', and 40' inserts are 110½" wide x 95" deep at joints. Top and adjacent 20' tapered insert are 80" wide x 67½" deep at joint. All boom sections joined by four pad-type, single-bolt connections. Boom top equipped with rope guard, cheek plates, and one sheave for dragline or two sheaves for clamshell. All sheaves 47" diameter, wide flanged, antifriction bearing mounted. Boom angle indicator standard. Telescopic boom stops standard on clamshell, optional on dragline. Basic boom length 100'; maximum length 140'.

MAST: 30' fabrication of reinforced box-type construction. Pivots on boom hinge pin. Provides geometry to

raise and support boom. Heavy duty mast with fleeting sheave standard for clamshell machines.

BOOM RIGGING: Twelve-part line reeved between back-hitch and mast sheaves. Controls boom angle by two single lines reeved from dual mast hoist drums. Moving mast connected to boom by four single-piece 1½" diameter pendants, furnished to match boom length.

WIRE ROPE GUIDE: Mounted on top side of boom top. One fleeting sheave for dragline, two for clamshell, antifriction bearing mounted.

WIRE ROPE ROLLER GUIDES: Mounted on top side of boom. Induction hardened, antifriction bearing mounted.

TAGLINE: Boom-mounted, three-barrel tagline with 30" wheel standard on clamshell. Optional roof mounted hydraulic tagline also available.

GENERAL

FIXED OPERATOR'S MODULE: Fully-enclosed and insulated steel module with large safety glass windows. Mounted in elevated position at right front corner of rotating bed. Isolates operator from machinery noise. Provides exceptional downward visibility. Air signal horn, windshield wiper, circulating fan, and dome light standard; heater and air conditioner optional.

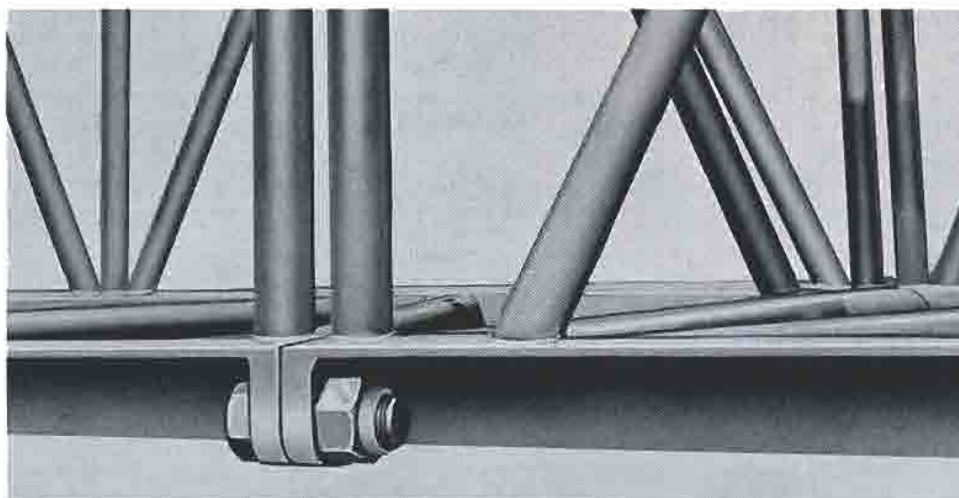
CONTROLS: Modulating air controls for main functions. With standard two-engine power system, each function's control lever operates both clutch and throttle. First lever movement engages clutch, further movement increases engine RPM. With optional single engine and two VICON® controlled torque converters, first lever movement sets clutch and further movement increases converter output for variable speed and torque. Drum brakes air-operated with foot pedal control. Drum parking brakes spring-set, air-released, and automatically applied if air pressure is lost. Slide pinion operated manually. Swing lock air-operated.

SPEED: Variable, 2.4 RPM maximum.

TRAVEL SPEED: Variable, 1.0 MPH maximum.

GRADEABILITY: 30%.

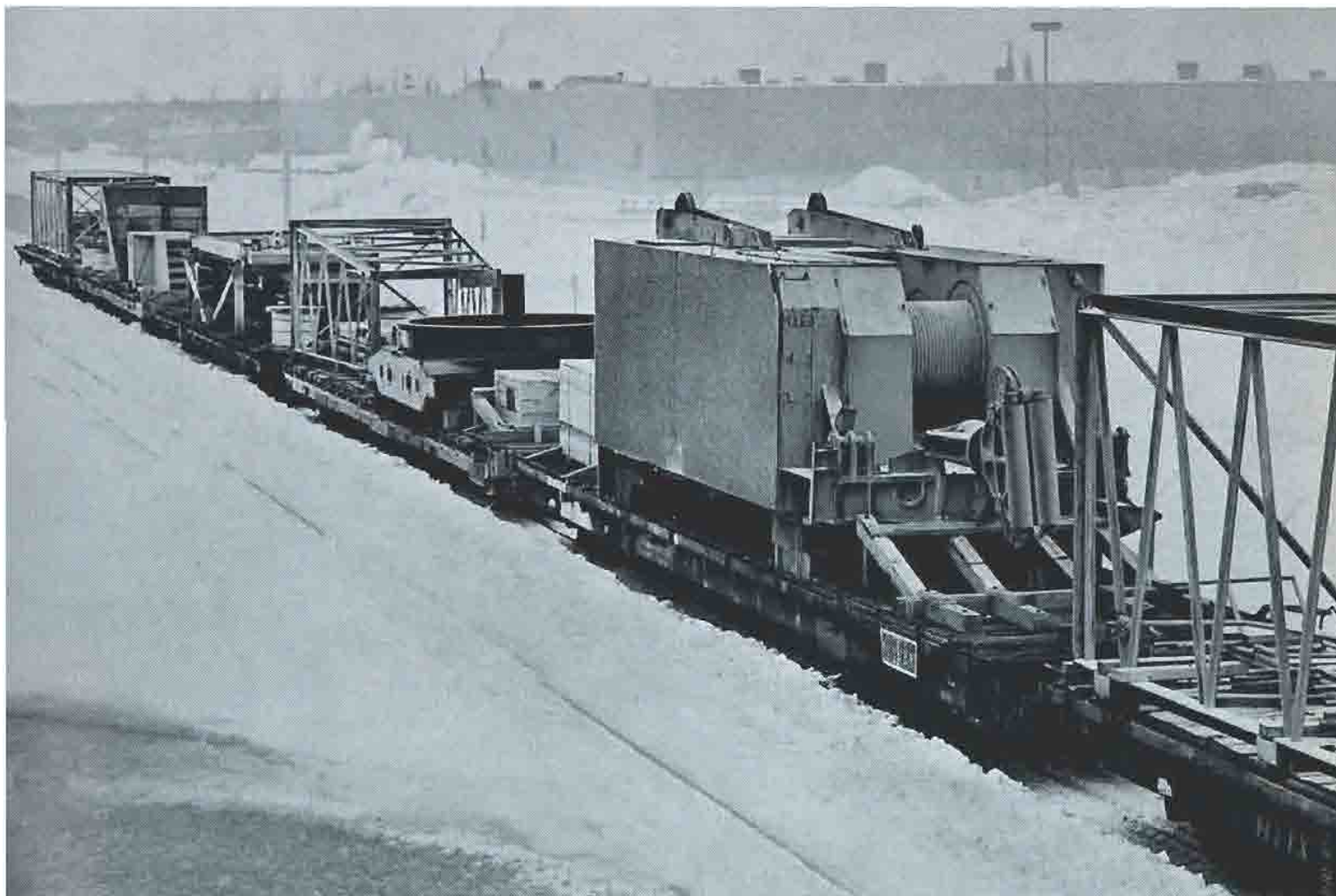




BOOM SECTIONS: Rugged construction assures sturdy boom for duty-cycle applications. Inverted-angle chords provide flat surfaces for solid butt-type joints with lacings, which are precision-aligned in jigs for flat bearing on chords. Boom butt, inserts, and top are solidly joined with a pad-type connection at each chord, secured by a single large bolt for fast alignment and assembly. An elastic stop nut on each bolt assures boom sections remain tight during operation.

SHIPABILITY: The Model 4600 Series-1 excavator is designed for shipment in major assemblies to simplify transportation and minimize set-up time in the field. The carbody is shipped complete with king pin and roller path. The crawlers are transported as finished assemblies,

designed to slide easily onto carbody wings and be secured with 12 bolts each. Major upperworks components, including the rotating bed, all machinery components, and large sections of machinery house, are shipped as a unit to minimize field assembly time.



Right: A barge-mounted 4600 clamshell, equipped with 100' boom and 7½-cubic yard bucket, dredges aggregate from the Allegheny River. Excavating at depths to 55', this 4600 produces an average of 550 to 600 tons of aggregate per hour.



Above: Two Model 4600 draglines equipped with 120' booms and 7½-cubic yard buckets excavate lime rock to create recreational lakes for a planned-community development. On this project, each 4600 excavated at depths to 45', cycled as fast as 45 seconds, and worked around-the-clock with 90% availability.

Right: A Manitowoc 4600 dragline, equipped with 140' boom and 7½-cubic yard bucket, works 18 hours a day, 6 days a week excavating rocky overburden at a West Virginia open pit coal mine. Providing 99% availability, this 4600 cycles every 50 seconds while digging at a 75' depth.



Because of a program of continuing improvements, Manitowoc Engineering Co. reserves the right to change specifications at any time, without notice.

MANITOWOC ENGINEERING CO.
Division of The Manitowoc Company, Inc.
MANITOWOC, WISCONSIN 54220

