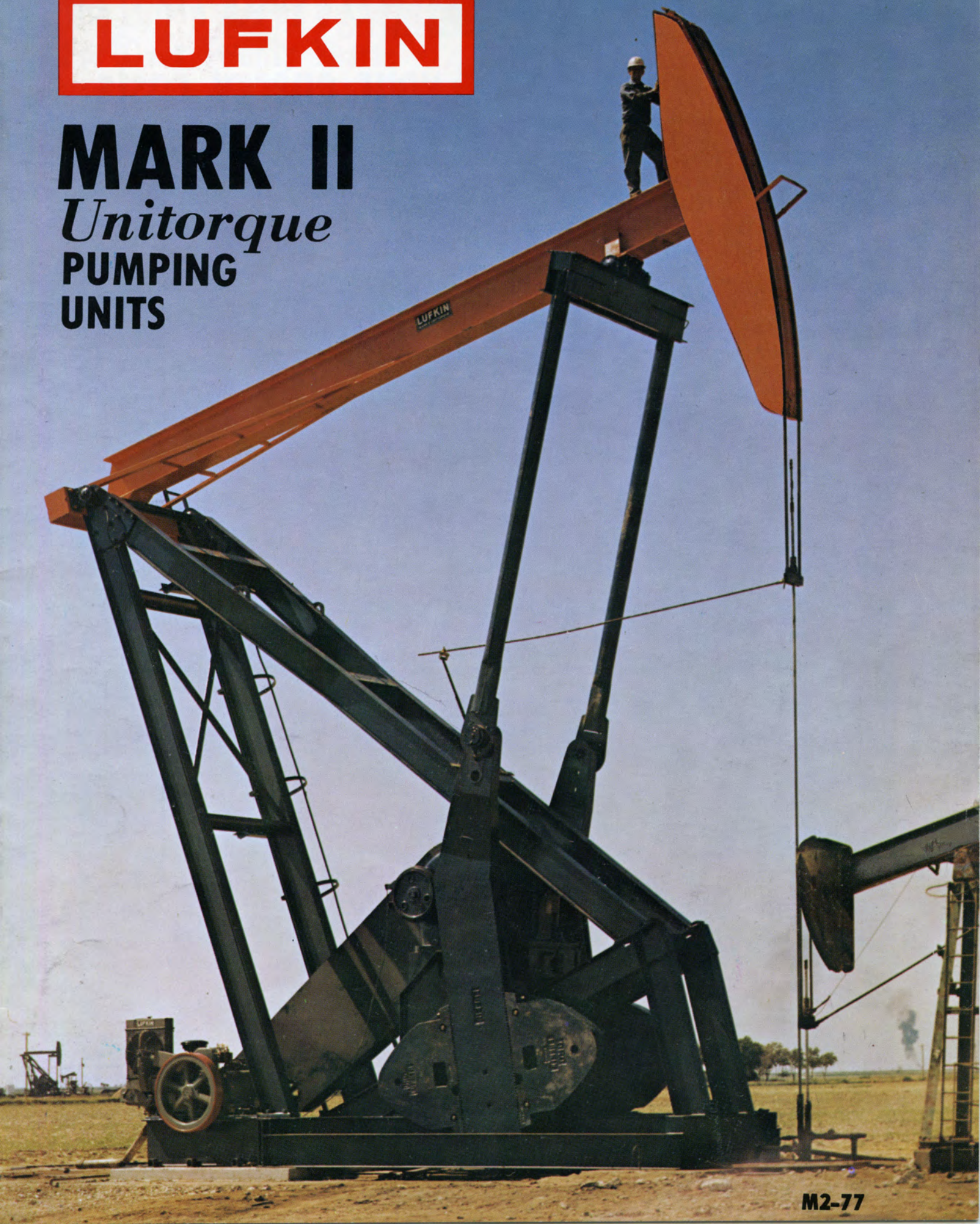
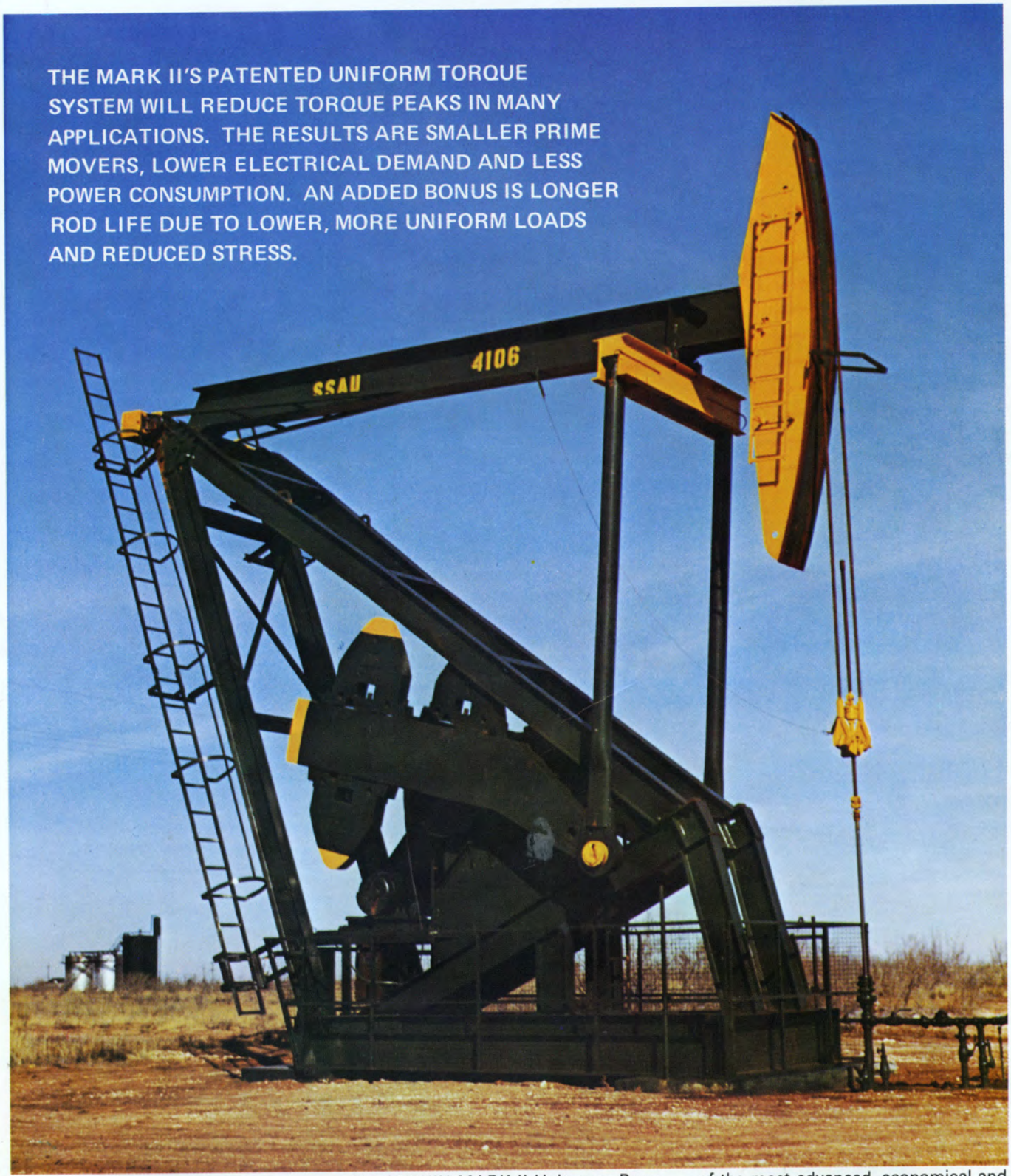
LUFKIN

MARK II
Unitorque
PUMPING UNITS



M2-77

Let Lufkin's Mark II lower your energy costs



COVER: M-640D-305-192 unit, with two point suspension, portable base and slow speed engine as prime mover.

The LUFKIN MARK II Unitorque Pumping Unit employs a unique kinematic concept made of the tried and proven structural components of the conventional mechanical pumping unit. The LUFKIN MARK II design furnishes one of the most advanced, economical and trouble-free systems of rod pumping available today, providing many money saving advantages not heretofore possible.

2C51

The Lufkin UNITORQUE SYSTEM - Field Proven For Over Twenty Years

The LUFKIN Mark II pumping unit is made up of the traditional components of walking beam, post, cranks, horsehead, pitman, etc., but arranged to form a reverse type geometry which normally develops different and improved performance characteristics.

The Mark II, with its patented uniform torque (UNITORQUE) system (1) generally smooths out and reduces peak torque by a substantial amount, in many cases enough to lower gear reducer and prime mover requirements by one API size; (2) often reduces rod and structural loads significantly; and (3) in most applications the Mark II, because of its unique design, may appreciably increase bottomhole plunger travel.

Peak torque reduction and smoothing result from the Mark II's special geometry which provides a lower upstroke maximum torque factor—thereby reducing upstroke torque; a higher downstroke torque factor, which tends to decrease maximum downstroke torque; and a phased crank system which permits the unit to work approximately the same over the top and bottom of the stroke as at mid up and down strokes. This normally provides a smoother net torque profile at the crankshaft, often permitting use of a smaller prime mover and speed reducer to handle a given polished rod load pattern. Although the Mark II does the same amount of torsional work at the crankshaft as other types of beam units—it simply drives more uniformly, often reducing peak torque requirements by as much as 40 percent. Additionally, the massive "propeller type" cranks of the Mark II offer a significantly higher rotary inertial torque (downstream) component which further reduces torque peaks and smooths out torsional demand.

The Mark II's unique, push-up geometry, with its low pitman-to-crank ratio, lifts the maximum load of rods and fluid off bottom with approximately 40 percent less acceleration than most other beam pumping unit types. Lifting the maximum mass of rods and fluid with a reduced maximum acceleration tends to decrease the unit's structural load significantly. Also, reduction in off bottom acceleration (while lifting maximum load) tends to reduce rod stress by a substantial amount, normally adding additional rod life.

Because of its faster downstroke and increased bottom reversal dwell time, greater net plunger travel often results. This Mark II feature, along with a greater pump barrel fill-time often maximizes productivity per stroke.

To date, over 300 different oil companies use the Mark II, which ranges in stroke length from 64 inches to a maximum of 216 inches. The torque capacity of the smallest unit is 114,000 inch pounds, running as high as 1,-280,000 inch pounds. The Mark II unit is manufactured in most API combinations. binations.

FIGURE A

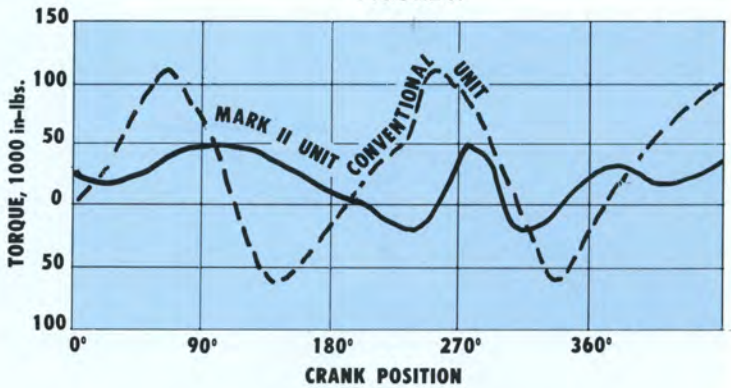


Figure A shows the measured crank shaft torque on turnabout comparison tests between a conventional pumping unit and a LUFKIN MARK II, pumping the same well with the same electric motor, under identical well conditions. The peak torque demand of 110,000 in. lbs. would require a 114-API gear reducer on conventional geometry, while the LUFKIN MARK II peak torque demand is only 65,000 in. lbs., requiring an API-80 reducer for the same application. This represents a Mark II torque reduction of approximately 40 percent.

A Lufkin Mark II Unit dressed up for the Bicentennial celebration. A Mark II similar to this one (M-320D-256-144) produces 4000 BF/D from a water supply well in North Central Texas. Initially the unit pumped between 4000 and 5000 BF/D (reported maximum 5860 BF/D with a 5¾" casing pump)

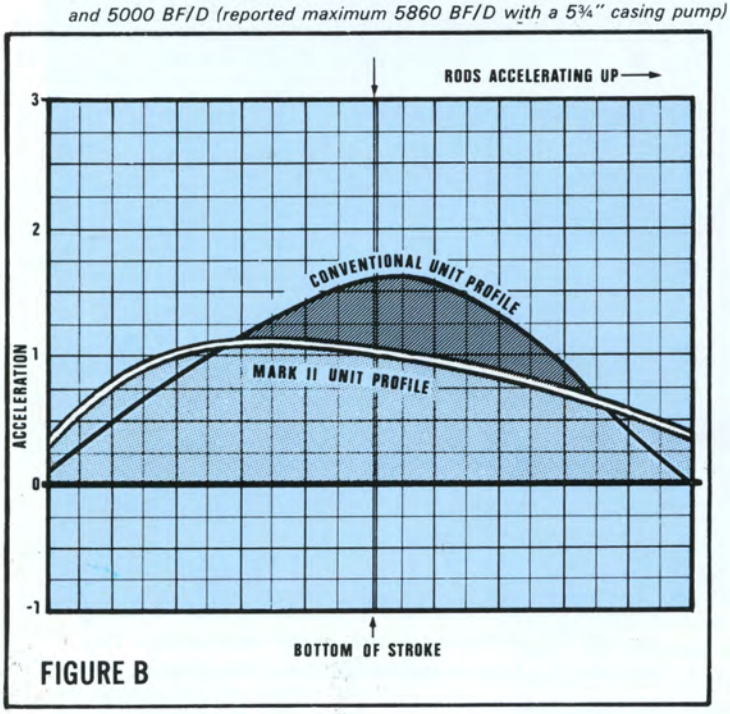


FIGURE B

Comparative Polished Rod Motion

Due to the unique geometry of the LUFKIN MARK II, the acceleration at the bottom polished rod reversal is decreased as much as 40 percent. This reduces peak load up to 15 percent and tends to avoid shock, resulting in longer rod life, lower servicing costs, and less production loss from rod break shutdowns.

The curves below (Figure B) show comparative accelerations at the bottom polish rod reversal for a conventional unit and the Mark II turning in synchronism. Note the Mark II's lower maximum acceleration and relatively smoother profile.

The Operator Benefits On:

SLIM HOLES—Where small diameter tubing limits the size of sucker rods, the lower rod stress obtained with the LUFKIN MARK II allows the use of longer rod strings or larger pumps.

DEEP HOLES—Extends range of sucker rod pumping to depths previously unattainable.

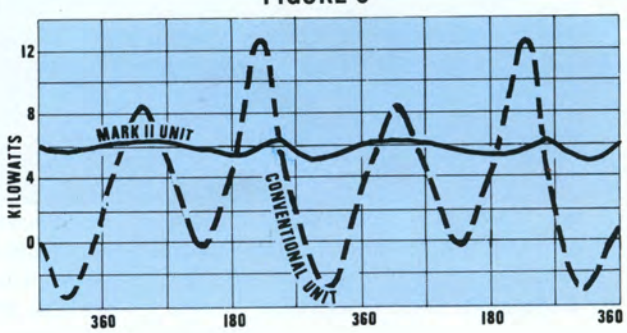
BIG VOLUME WELLS—Lowered peak load conserves a greater portion of the polished rod capacity for handling additional fluid.

Power & Prime Mover Savings

The LUFKIN MARK II, due to its more uniform torque demand, illustrated by the following power curves (Figure C) generally permits the use of a smaller prime mover to pump any given application. In the case of a gas engine drive, the first costs savings are substantial. With an electric motor drive, additional savings are obtained, when electric power charges are based on demand or connected horsepower. The following curves show watt meter studies on a head-to-head comparative test between a competitive conventional pumping unit and the LUFKIN MARK II, pumping the same well under identical conditions.

Where motors are used, the continual day-to-day savings in electrical consumption and demand charges may, in the long run, amount to as much or more than the first cost savings.

FIGURE C

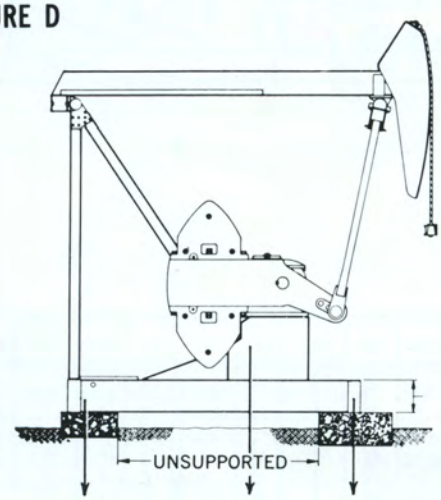


"Iron Horse" of a different color! . . . . Pictured above is the ever faithful cowboy, riding a different kind of "iron horse", a Lufkin Mark II pumping unit, located near Quitman, Texas.

An M-1280D-427-216 Lufkin Mark II pumping 1050 BOPD from almost 8,000 feet with 2¼ inch pump at Farnsworth Unit Well 15-3.

Two-Point Suspension *(FIG. D)*

FIGURE D



ALL RESULTANT FORCES ARE DOWNWARD ELIMINATING NECESSITY FOR MASSIVE CONCRETE BLOCKS TO AVOID LIFT UP.

Extra heavy "two point suspension" base reduces concrete requirement by approximately 80 percent.

Small, portable type foundation blocks can be used, thus making the entire installation 100 percent salvable.

Ideal for areas where drifting sand and snow is a problem.

Both concrete and gravel-filled, fabricated "Two-Point" piers are now extensively used on most Mark II Units. In many applications the "Two-Point" mounting offers a substantial first cost savings, when the total package of unit and foundation is considered.

General Dimensions and Specifications

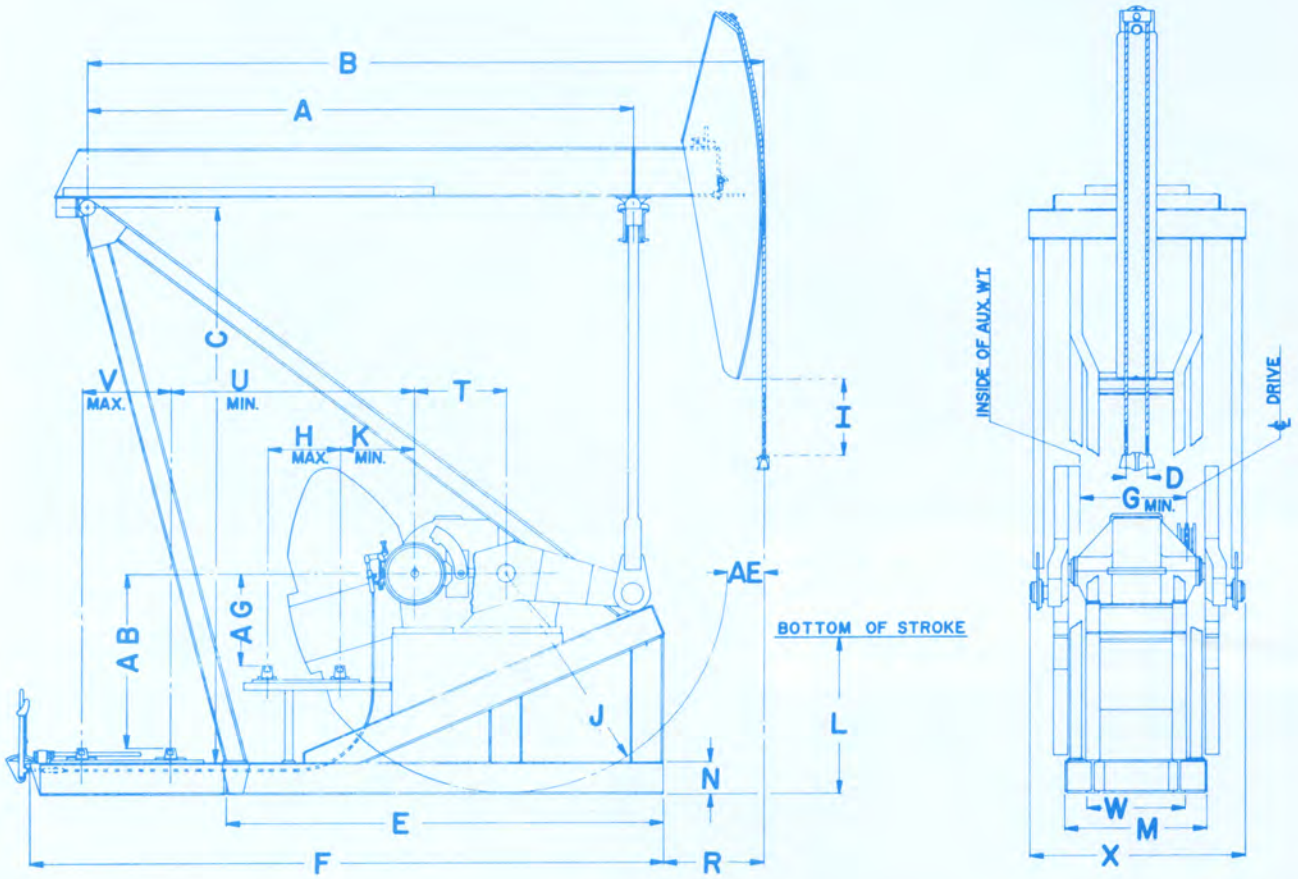


FIGURE E

UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	R	T	U	V	W	X	AB	AE	AG
M-1280D-427-216	25′-6″	32′-0″	27′-5⅞″	16″	18′-7″	25′-2½″	57⅜″	55″	47¼″	130″	31¾″	68⅝″	8′-0″	18″	45″	52½″	11′-3¼″	48½″	48½″	9′-6″	9′-6″	26″	51″
M-1280D-427-192	“	“	“	“	“	“	“	“	72½″	“	“	71¼″	“	“	“	“	“	“	“	“	“	“	“
M-912D-305-216	“	“	“	“	“	“	54″	51¾″	47¼″	“	23″	68⅝″	“	“	“	48½″	“	“	“	9′-1″	“	“	59⅛″
M-912D-305-192	“	“	“	“	“	“	“	“	72½″	“	“	71¼″	“	“	“	“	“	“	“	“	“	“	“
M-912D-365-168	22′-6″	27′-10″	23′-0⅛″	12″	18′-2¾″	24′-10¼″	“	46¾″	42¾″	108″	25½″	71½″	6′-9½″	16″	48″	“	9′-2″	“	50″	8′-9″	7′-8″	19″	46⅛″
M-912D-305-168	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“
M-912D-365-144	21′-6″	26′-0″	21′-0⅞″	“	“	“	“	“	40″	“	“	75⅛″	“	“	42½″	“	“	“	“	“	“	13½″	“
M-912D-305-144	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	8′-7⅜″	“	“	“
M-640D-305-192	25′-6″	32′-0″	27′-5⅞″	16″	18′-7″	25′-2½″	50¼″	51¾″	72½″	130″	26⅜″	71¼″	8′-0″	18″	45″	41½″	11′-3¼″	“	48½″	8′-9″	9′-6″	26″	60⅛″
M-640D-305-168	22′6″	27′-10″	23′0⅞″	12″	18′-2¾″	24′-10¼″	“	46¾″	42¾″	108″	27⅞″	71½″	6′-9½″	16″	48″	“	9′-2″	“	50″	8′-5″	7′-8″	23⅜″	46⅛″
M-640D-365-144	21′-6″	26′-0″	21′-0⅞″	“	“	“	“	“	40″	“	“	75⅛″	“	“	42½″	“	“	“	“	“	“	18″	“
M-640D-305-144	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	8′-3⅜″	“	“	“
M-640D-256-144	“	“	“	9″	“	“	“	“	44¼″	“	“	71⅝″	“	“	“	“	“	“	“	“	“	“	“
M-640D-305-120	“	“	“	12″	“	“	“	“	64¾″	“	“	75⅛″	“	“	“	“	“	“	“	“	“	“	“
M-456D-305-192	25′-6″	32′-0″	27′-5⅞″	16″	18′-7″	25′-2½″	“	51¾″	72½″	130″	29¾″	71¼″	8′-0″	18″	45″	38⅜″	11′-3¼″	“	48½″	8′-9″	9′-6″	26″	60⅛″
M-456D-305-168	22′-6″	27′-10″	23′-0⅞″	12″	18′-2¾″	24′-10¼″	“	46¾″	42¾″	108″	31″	71½″	6′-9½″	16″	48″	“	9′-2″	“	50″	8′-5″	7′-8″	23⅜″	46⅛″
M-456D-365-144	21′-6″	26′-0″	21′-0⅞″	“	“	“	“	“	40″	“	“	75⅛″	“	“	42½″	“	“	“	“	“	“	18″	“
M-456D-305-144	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	8′-3⅜″	“	“	“
M-456D-256-144	“	“	“	9″	“	“	“	“	44¼″	“	“	71⅝″	“	“	“	“	“	“	“	“	“	“	“
M-456D-365-120	“	“	“	12″	“	“	“	“	64¾″	“	“	75⅛″	“	“	“	“	“	“	“	8′-5″	“	“	“
M-456D-305-120	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	8′-3½″	“	“	“
M-456D-256-120	“	“	“	9″	“	“	“	“	69″	“	“	71⅝″	“	“	“	“	“	“	“	“	“	“	“

General Dimensions and Specifications

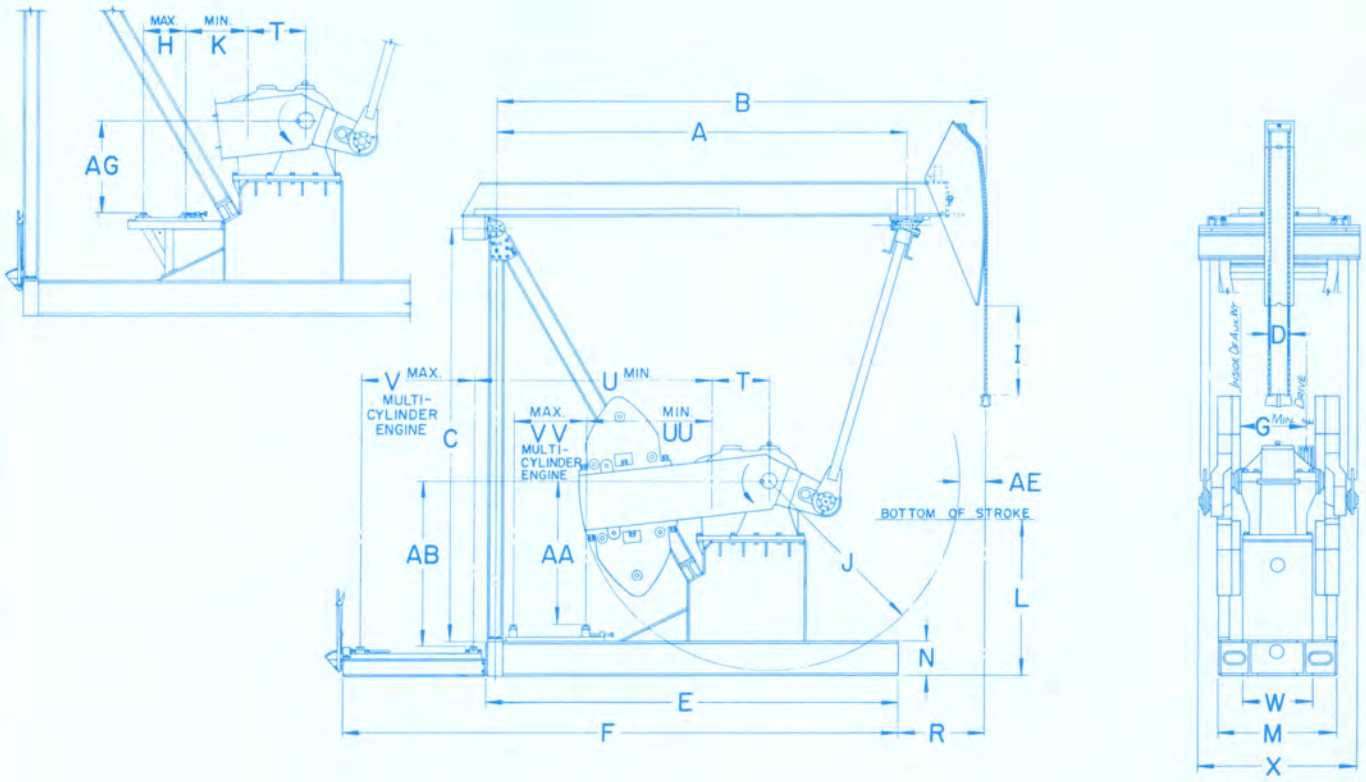
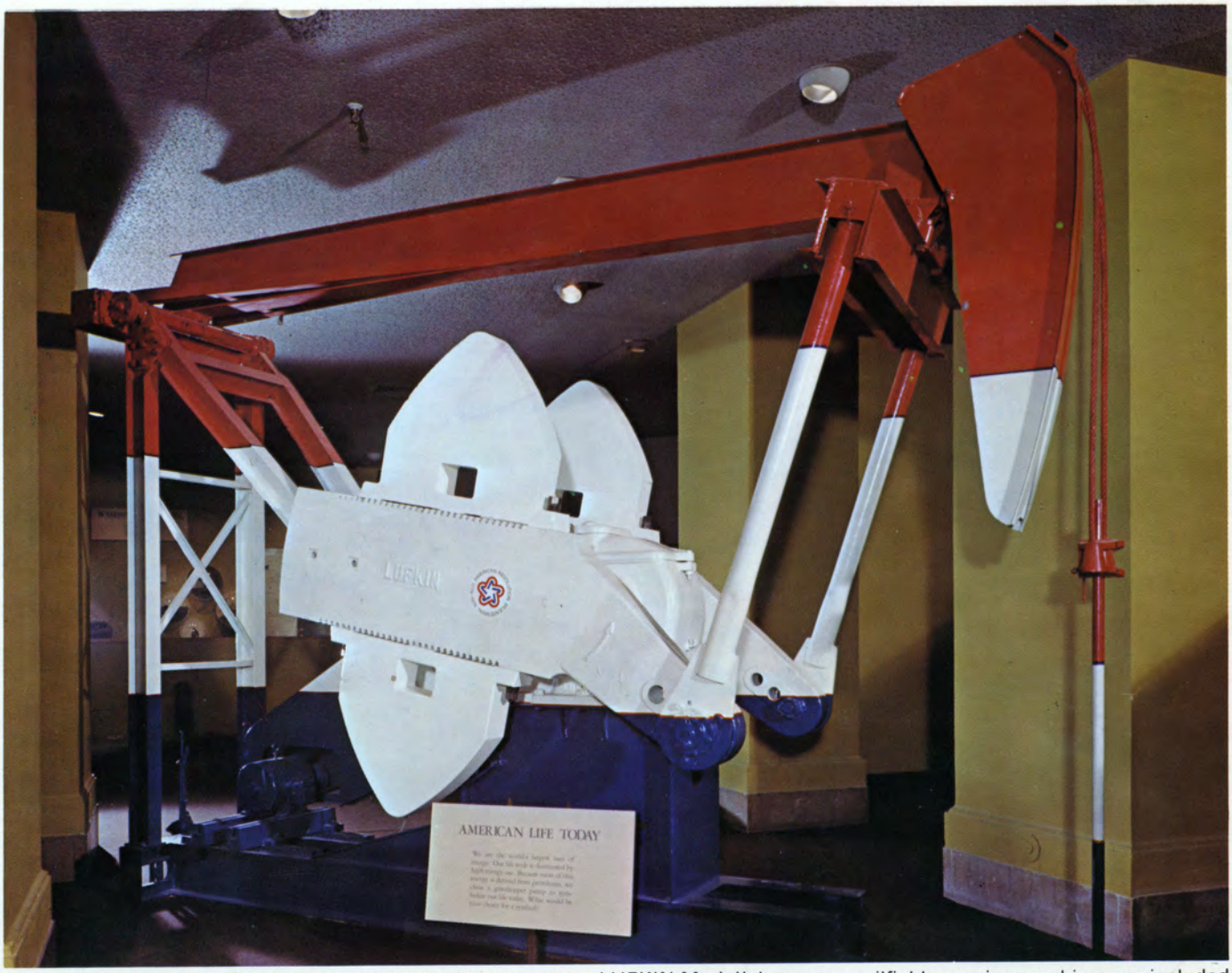


FIGURE F

UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	R	T	U	V	W	X	AA	AB	AE	AG	UU	VV
M-320D-256-144	21′-6″	26′-0″	21′-0⅞″	9″	21′-3½″	29′-2″	44½″	33¼″	44¼″	108″	35⅛″	79⅜″	69¾″	24″	60″	34″	9′-4⅜″	68⅛″	43½″	7′-4⅛″	7′-2″	9′-0⅛″	18″	46⅛″	7′-4″	51½″
M-320D-305-120	“	“	“	12″	“	*	“	“	64¾″	“	“	83⅛″	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-320D-256-120	“	“	“	9″	“	*	“	“	69″	“	“	79⅜″	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-320D-213-120	“	“	“	“	“	*	“	“	“	“	“	“	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-320D-305-100	“	“	“	12″	“	*	“	“	7′-1″	“	“	52⅝″	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-320D-256-100	“	“	“	9″	“	*	“	“	7′-5″	“	“	79⅜″	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-228D-256-120	“	“	“	“	“	*	38⅞″	29¼″	69″	“	41⅛″	“	“	“	“	30″	*	*	37″	6′-9⅜″	“	*	“	47⅞″	7′-8″	“
M-228D-213-120	“	“	“	“	“	*	“	“	“	“	“	“	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-228D-256-100	“	“	“	“	“	*	“	“	7′-5″	“	“	“	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-228D-173-100	“	“	“	“	“	*	“	“	“	“	“	“	“	“	“	“	*	*	“	“	“	*	“	“	“	“
M-228D-246-86	15′-6″	18′-6″	15′-8⅜″	“	15′-6½″	21′-0″	“	30¼″	40¾″	86⅝″	22¼″	75⅝″	57″	“	39″	“	8′-7¾″	51½″	“	6′-8⅜″	**	6′-3″	11⅜″	40½″	**	**
M-228D-213-86	“	“	“	“	“	“	“	“	“	“	“	73¼″	“	21″	“	“	“	“	“	“	**	“	“	“	**	**
M-228D-200-74	“	“	“	“	“	“	“	“	52½″	“	“	“	“	“	“	“	“	“	“	“	**	“	“	“	**	**
M-228D-173-74	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	**	“	“	“	**	**
M-160D-213-86	“	“	“	“	“	“	32⅞″	33¼″	40¾″	“	24½″	72⅝″	54″	“	“	26″	8′-11¼″	“	32″	6′-0⅜″	**	“	“	38¾″	**	**
M-160D-173-86	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	**	“	“	“	**	**
M-160D-200-74	“	“	“	“	“	“	“	“	52½″	“	“	73¼″	“	“	“	“	“	“	“	“	**	“	“	“	**	**
M-160D-173-74	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	**	“	“	“	**	**
M-114D-143-86	13′-6″	15′-9″	12′-3½″	“	13′-0¾″	18′-6¼″	29⅜″	30″	14¼″	62″	20⅛″	55⅜″	42¾″	16″	36″	24″	8′-0½″	“	25″	67⅜″	**	50″	16″	31⅛″	**	**
M-114D-173-74	15′-6″	18′-6″	15′-8⅜″	“	15′-6½″	21′-0″	“	30¾″	52½″	86⅝″	28″	73¼″	54″	21″	39″	“	9′-1¾″	“	“	69″	**	6′-3″	11⅜″	43¼″	**	**
M-114D-143-74	13′-6″	15′-9″	12′-3½″	“	13′-0¾″	18′-6¼″	“	30″	26⅛″	62″	20⅛″	55¼″	42¾″	16″	36″	“	8′-0½″	“	“	67⅛″	**	50″	16″	31⅛″	**	**
M-114D-173-64	“	“	“	“	“	“	“	“	20½″	“	“	70⅝″	“	“	“	“	“	“	“	“	**	“	“	“	**	**
M-114D-143-64	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	**	“	“	“	**	**

* On 100″, 120″, 144″ and 168″ Stroke Units, Multi-Cylinder Engines are Mounted on Main Base Beams Forward of Samson Post. See Dimensions UU, VV, and AA.
** On 64″, 74″, 86″ and 192″ Stroke Units, Multi-Cylinder Engines are Mounted Behind the Samson Post. See Dimensions U, V and AB.



To symbolize America's dependence upon petroleum energy, a LUFKIN Mark II, beam type oilfield pumping machine was included in the Smithsonian's Bicentennial Exhibit, "OUR CHANGING LAND." This particular Mark II pump was in field service 14 years and produced approximately five million barrels of fluid (oil and water) from the Wall Creek Formation, in central Wyoming. The Mark II, one of the most modern beam pumping unit designs in current use, is the first, full-size oilfield pumping unit ever exhibited by the Smithsonian Institution.

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