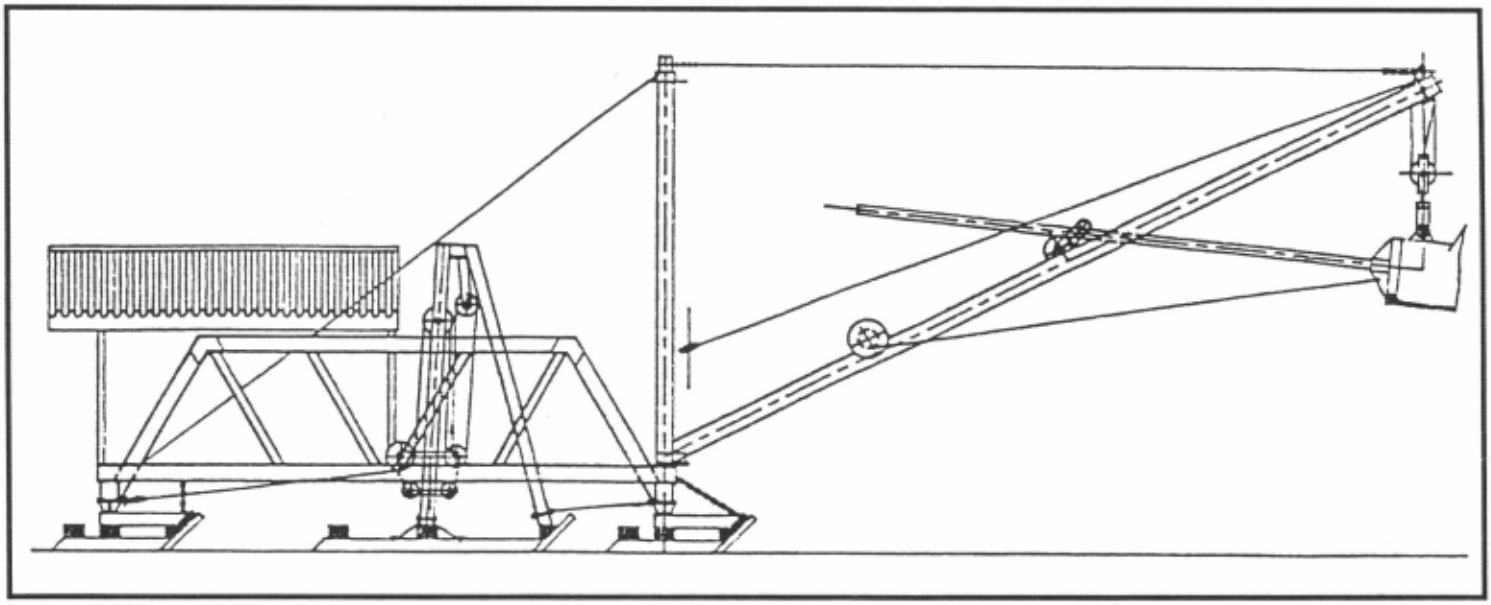
BAY CITY WALKING DREDGE NO.489
A NATIONAL HISTORIC
MECHANICAL ENGINEERING LANDMARK



COLLIER-SEMINOLE STATE PARK

ASME - CALOOSA SECTION
FEBRUARY 19, 1994

The American Society of
Mechanical Engineers

THE TAMIAMI TRAIL

The Tamiami Trail was first proposed in 1910 to connect Tampa on the west coast of Florida with Miami on the east coast. It was a formidable project. The road had to be built through the Florida Everglades which was literally "a sea of grass and water."

At first progress was slow because the state of Florida had an impractical policy on road building. Each community was expected to establish a road and bridge district and sell bonds to finance construction within its boundaries. Populous Dade County had completed 43 miles westward from Miami by 1918. Population was scanty on the west coast so construction was very slow.

The project got a boost in 1923 when Barron Collier, a real estate magnate, persuaded the Florida legislature to create Collier County out of the southern part of Lee County. He lost no time in resuming construction on the Trail but the task was daunting. The Everglades was crossed through "muck, misery and mocassins." The Florida boom was underway so labor was short. Turnover was high because of the wretched living conditions at the construction site. Barron Collier was once asked how many shifts he worked the men. His answer was three shifts—one coming from Tampa, one working on the Trail and one returning to Tampa.

By 1926, after having spent more than one million dollars, Barron Collier still had 31 miles of road to construct to reach the Collier-Dade county line. Even worse, this construction had to be blasted through solid limestone, beneath the swampy surface, to provide fill for the roadbed. Then politics muddied the water. The construction westward from Miami was being done by the Chevelier Corporation headed by Capt. Jaudon. Chevelier had purchased a considerable amount of land in Monroe County, located south of Collier County. Naturally Jaudon located the road to cross his land. Meanwhile Barron Collier located his road to pass through his land holdings in Collier County. In 1925 John Martin was elected Governor with the pledge to complete the Tamiami Trail "come hell or high water." The state took over the project in 1926 and soon resolved the alignment problem in favor of Barron Collier's route, which explains the diagonal "dog leg" in the middle of the trail.

Through the difficult Everglades the grass and muck had to be removed exposing the rock. Holes were drilled in the rock, dynamite inserted in the holes and the rock was then blasted to break it up. Altogether over two and one half million sticks of dynamite were used. Walking Dredges, which straddled a 20 ft. wide canal, scooped up the crushed rock and created a roadbed parallel to the drainage canal.

The Tamiami Trail was opened to traffic on March 27, 1927 and is still in use as US Highway 41. In 1955 the American Society of Civil Engineers pronounced the Tamiami Trail "An Engineering Wonder."

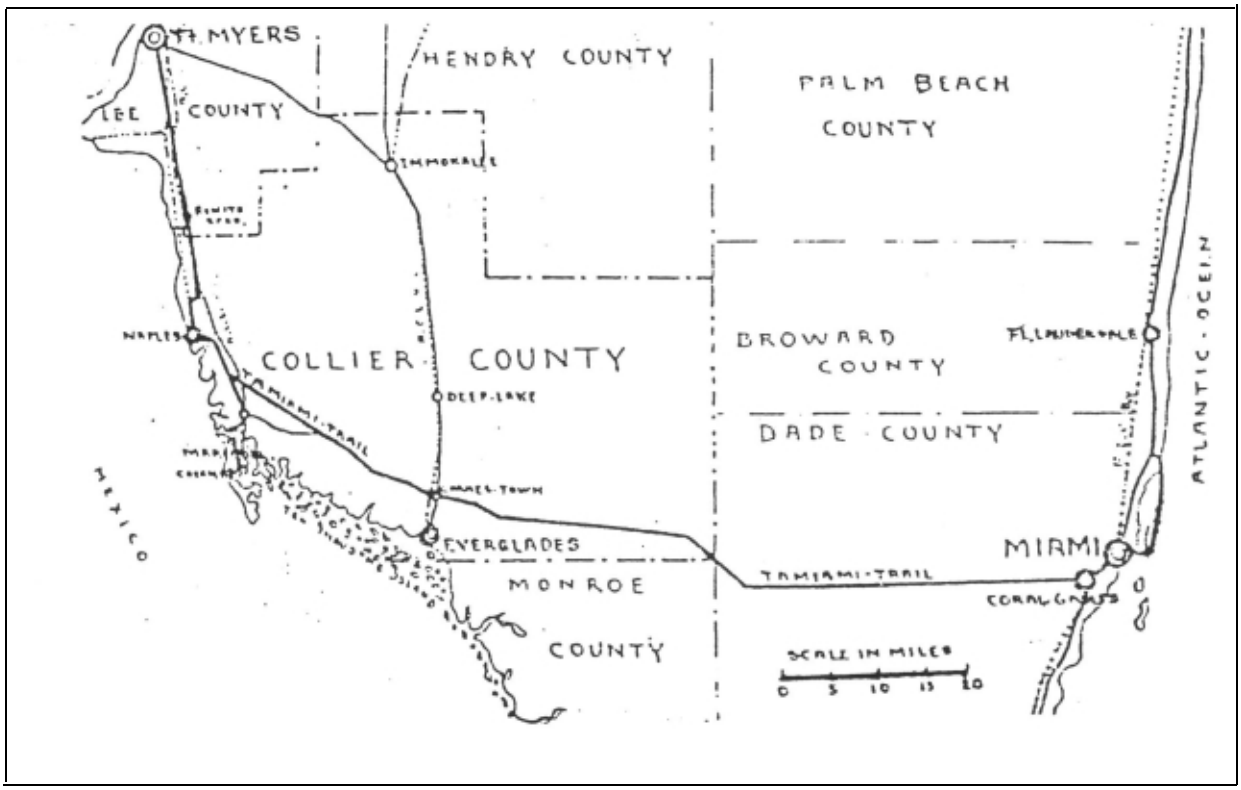


FIG. 1 – SOUTHERN FLORIDA – 1928

THE BUILDER'S CONCEPT

Beginning about 1880, a powered machine was developed in the Midwest with the object of digging ditches and canals to drain swampy land. In the state of Michigan alone 3.1 million acres (1,254,515 hectares) of wetlands were drained to make productive farmland.

The Bay City Company of Bay City, Michigan was a prominent manufacturer of these machines, producing 267 of them between 1914 and 1930. These dredges were used in places as far away from Michigan as California and Florida.

The Bay City machines were termed Dry-Land Dredges. Each ran astride the ditch it dug. The machine was light and its weight could easily be distributed over a large area of ground to bring the bearing weight down to 625 lbs. per sq. ft. (29.93 kPa). Most crawling type traction machines had a bearing weight of 1400 to 1500 lbs. per sq. ft. (67.03 to 71.82 kPa). The comparative lightness of the machine enabled it to work over ground which would not support a heavy drag-line machine with crawlers. The machines were designed using truss structures and internal combustion engines as weight saving features.

William J. Burnett and William Billington of Bay City, Michigan probably developed the concept of mounting the dipper and engine on a platform which rode on portable tracks. This machine required four men—two track men, one operator, and one engineman.

The Bay City Company then introduced in 1916, the walking-type dredge utilizing a propelling apparatus invented by Vincent G. Anderson. This machine is described in the subsequent article. The walking dredge required only two men because the two trackmen were not needed, and it became very popular because of the greater economy. Many existing machines running on track were eventually converted to the walking-type design.

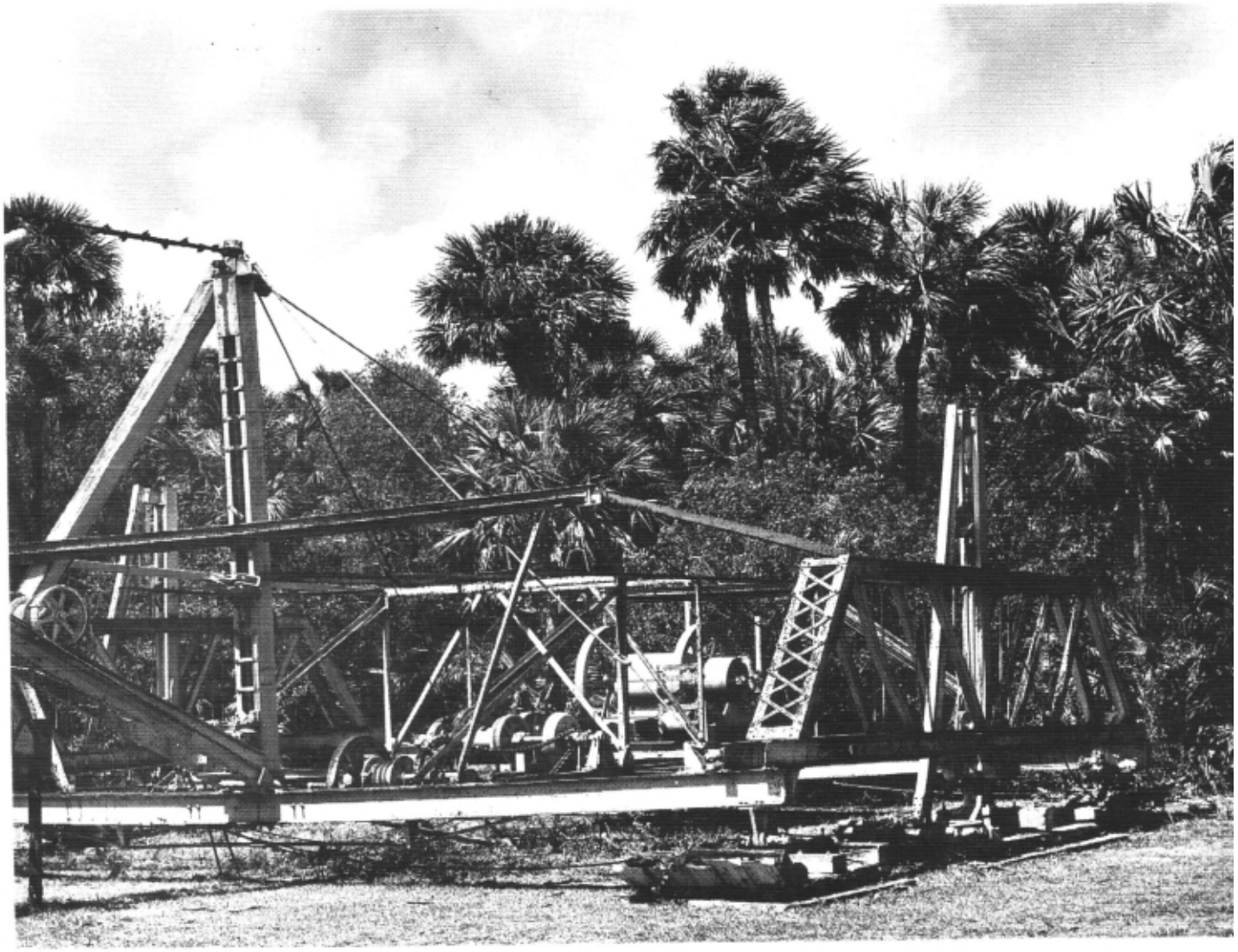
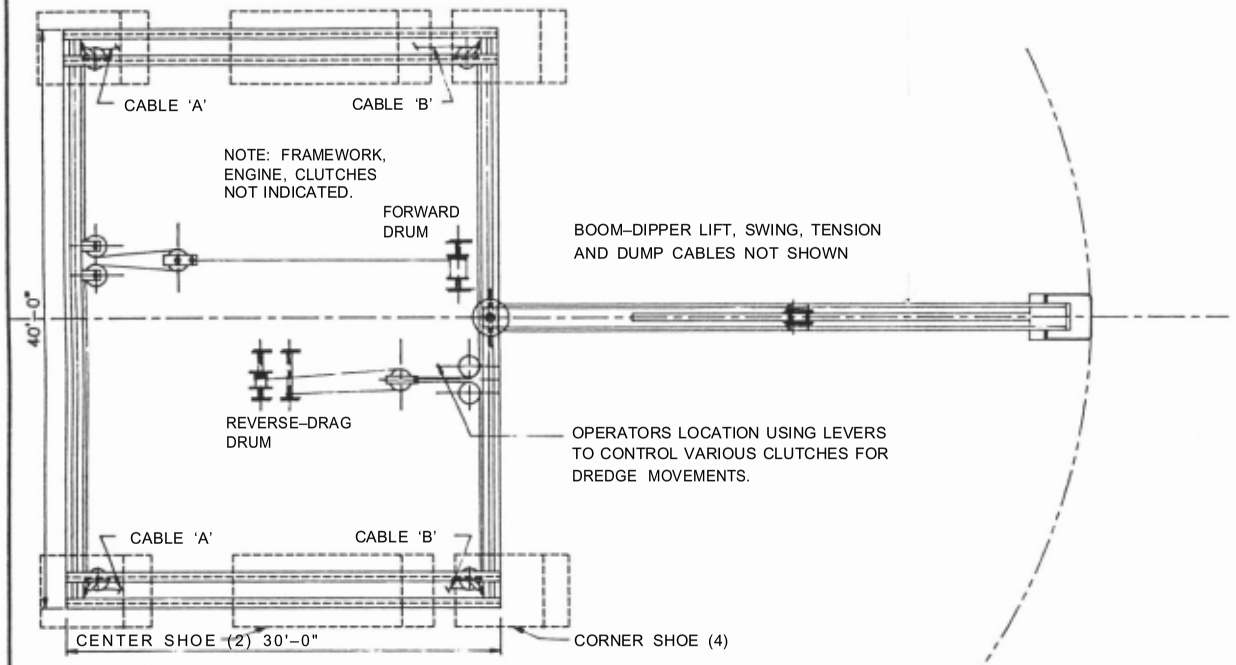


FIG. 2–WALKING DREDGE SHOWING WOODEN SHOES



PLAN VIEW OF WALKING SHOE CABLES AND DRUMS

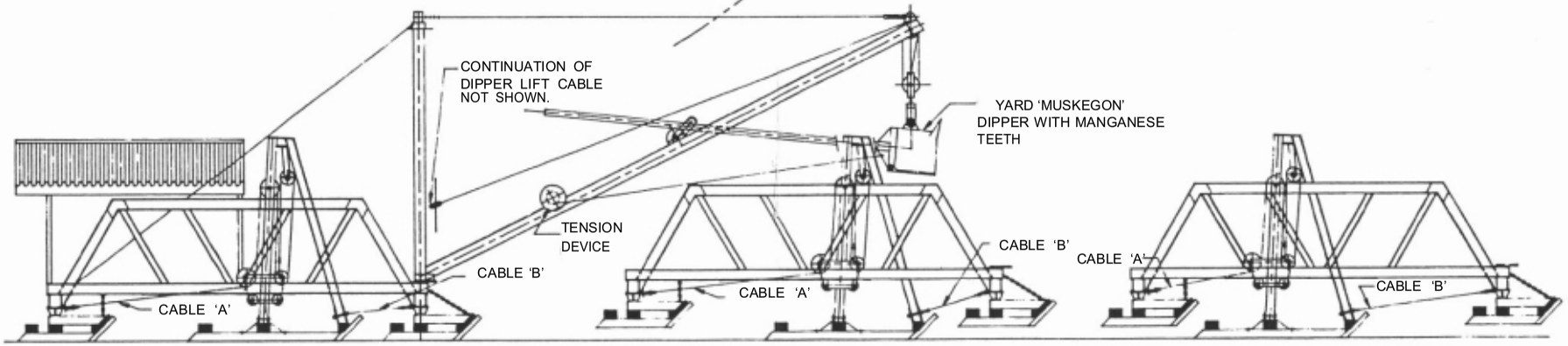
HOW THE DREDGE WALKS

In plan view, the dredge machinery is mounted on a rectangular frame with the boom and dipper attached at the center of the "front" edge (Fig. 3). The dredge normally rests on four skid-like shoes, one at each corner of the frame. Each shoe is made of 5ft. x 6ft. (1.5m x 1.8m) timbers.

Between the front and rear shoes on each side is a center shoe made of 5ft. x 12ft. (1.5m x 3.6m) timbers. Cable A comes from the rear corner of the dredge frame and passes over a system of pulleys and sheaves on the trolley and A-frame (Fig. 3) when the cable is pulled, it first pushes the center shoe down and takes the weight off the front and rear corner shoes, Cable B comes from the front corner of the dredge frame and is attached directly to the center shoe. Each cable is wound on a drum connected to the dredge engine through friction clutches.

"Walking" is accomplished as follows. The action is the same on both sides of the dredge. With cable A released, the operator engages the clutch to pull on cable B which drags the center shoe and its trolley forward towards the front corner. Cable B is then released, and the operator engages cable A which initially pushes the center shoe against the ground and takes the weight off the corner shoes. Further pulling on cable A rolls the frame forward on the trolley and forces the shoes to slide forward. The dipper was often used to provide additional forward pull. [Note that the drawing (Fig. 3) shows the corner shoes and dredge lifted one foot (0.3m) for the sake of clarity. In practice the machine was only lifted enough to remove the weight from the corner shoes.] While the center shoes and A-frames remain stationary, the dredge frame moves forward about ten feet (3m). Both the cable A and Cable B drums are then released to allow the dredge to rest on the corner shoes. After dredging the walking cycle is repeated to move the dredge to the next section.

The dredge could be backed up by reversing the cycle of operations.



RIGHT ELEVATION SHOWING DREDGE IN OPERATING POSITION, READY TO ADVANCE FORWARD

DREDGE SHOWN LIFTED BY PULLING ON REAR CABLE 'A'

VIEW SHOWING MAINFRAME MOVED FORWARD FIVE TO TEN FEET BY CONTINUING PULL ON REAR CABLE 'A' PULLING ON CABLE 'B' WILL SLIDE CENTER SHOE FORWARD, READY FOR NEXT MOVING CYCLE.

FIG. 3–GENERAL ARRANGEMENT SHOWING WALKING SYSTEM

PERFORMANCE OF THE ONE YARD WALKING DREDGE

The performance for a one yard 30hp machine has been recorded. No. 489 had a 50hp engine so it was probably faster and burned more fuel.

The engine on the one yard (one cubic yard and 0.765 cubic meters) machine was 30 hp (22.37 kw) and used 28-32 gallons (106-121 liters) of kerosene in ten hours of work. The single or multi- cylinder engine started on gasoline and ran on kerosene or distillate.

The walking type dredge could move up six feet (1.83 m) in forty five seconds. It could walk across country at the rate of one mile (1.6 km) per day.

These machines have a one yard (0.785 cubic meters) dipper and while they are not so strong or rugged as the standard dipper dredge, they are able to dig fairly hard blue clay. The one yard machine would dig seven hundred cubic yards (534.8 cubic m) of this material in ten hours with an experienced operator. This amounted to seventy seconds per cycles of digging, swinging, dumping and moving forward.

The machinery was similar to a small dipper dredge with a boom, dipper handle and dipper. The boom was light and was swung by lines which took hold of the boom near the middle of its length and then passed over sheaves on the four corners of the machine.

The dredge had its own shop for making repairs to the bearings, clutches, sheaves, cables and dipper. The life of the dipper teeth was very short. In some cases they had to be replaced every two days.

The machines could be knocked down and moved to a new location and set up again ready for work in a few days. The knocking down and setting up required four or five men five or six days.

All of the clutches operated by hand without difficulty.

The sound of the engine was unforgetable to those men who operated the dredge:

POP-chugga-chugga-chugga-POP-chugga-chugga-chugga.

THE MANUFACTURER'S MAINTENANCE AND OPERATING INSTRUCTIONS

REMARKS

Keep all bearings well oiled. It saves power as well as wear.

When a nut works loose, tighten it at once; it is useless when loose.

Should a bolt break, put a new one in its place immediately — that takes the additional strain from the others.

Don't drop the dipper and then stop it suddenly to dump its contents, unless you want to break something.

Don't start to swing until the dipper is clear of the solid material being excavated, and don't stop swinging with a jerk.

Don't run your cables dry — a good cable dressing prolongs the life of both the cables and the sheaves over which they work.

Don't try to economize by using cheap grades of kerosene, gasoline and lubricating oil — unless you are anxious to increase your repair and operation expense.

Don't allow the dipper to strike the bottom of the ditch hard, when the dipper handle is in or near a vertical position — unless you want to break the dipper front or jam it out of shape. This is especially true on a hard bottom.

When your dipper is full, it's full, so hoist and dump it — to try to pile more on, wastes time and power.

When operating your Dredge in heavy timber, blow the stumps — dynamite is cheaper than machinery and while the Dredge would probably pull them out whole, it is usually false economy to do so.

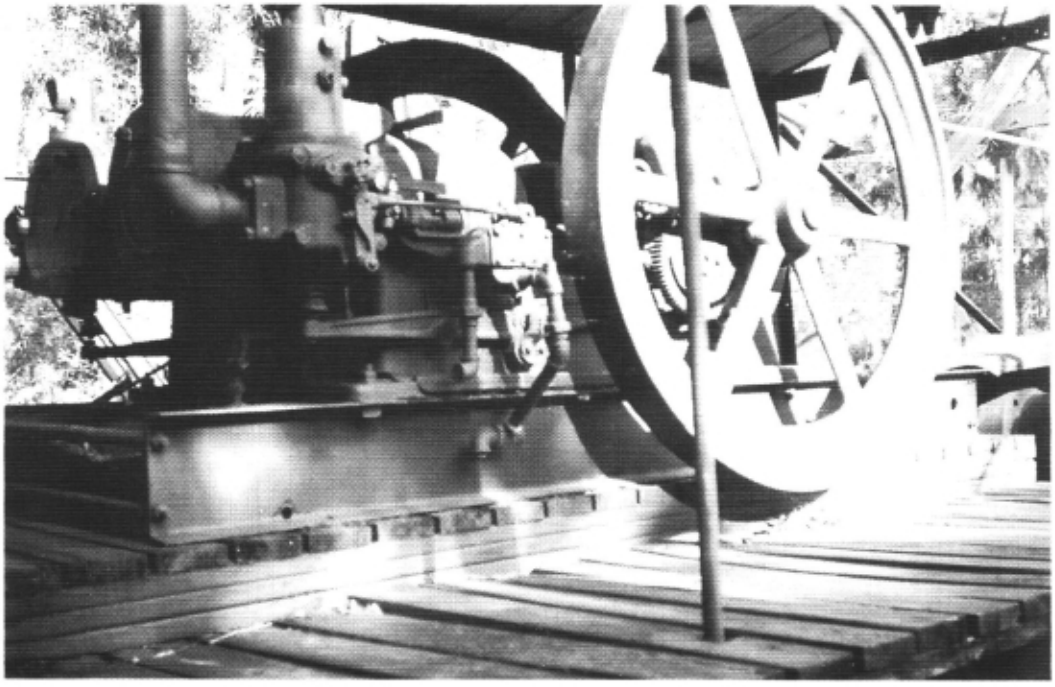


FIG. 4 – 50H.P. TWIN CYLINDER MULTI-FUEL ENGINE

SPECIFICATIONS FOR BAY CITY WALKING LAND DREDGE NO. 489

Span—33 ft.

Front crossbeams—12"—31.8# Beams—40 ft. long.

Two center longitudinal Beams—12"—31.6 #Beams—28 ft. long.

Two outside longitudinal Beams—10"—25# Beams—28 ft. long.

One-Yard Muskegon Dipper—34" deep with Manganese Lip and Teeth H-292 with H-177-H-178 Dipper Hinge.

Three Dipper Teeth, Manganese H-408.

8" Dipper Handle, 26 ft. long with 5" pipe (3 ft. long in bottom).

40 ft. Boom using 12"—25# Channels. 1/2" x 12" Plates inside.

50 H.P. Charter, two-cylinder Engine No. 8434, 24" Clutch Pulley.

Center shoes, 5 ft. x 12 ft.

Corner shoes, 5 ft. x 6 ft.

Sectional Wood House with corrugated metal roof.

Cable Dipper Control.

Steel Truss over rear axle, reinforced.

1-1/2" Truss Rods under front and rear axles.

24" Clutch Pulley Complete, 4" bore.

Swing tension device.

Band type Hoist Clutch—5/16" x 4" Asbestos Lining.

1/2" x 12" Plate over front axle—16 ft. long.

30 ft. Bridge Franes with 1/2" x 12" Plates underneath.

Note: *A complete one yard dredge with forty ft. of boom, a thirty-six to thirty-nine-ft. span, and a thirty-hp engine sold for about $4,000 in 1924.*

HOW THE BAY CITY WALKING DREDGE NO. 489 WAS SAVED

Bay City Walking Dredge No. 489 was built in Bay City, Michigan in May, 1924 and was shipped to W.R. Wallace & Co. of Fort Myers, Florida. The dredge was later sold to Alexander, Ramsey and Kerr, a construction company controlled by Barron Collier. During 1927-1928, the dredge was used to construct that portion of the Tamiami Trail (US41) beginning at Black Water River and extending Northwest ten miles to Belle Meade Crossing (intersection of US41 and FL951).

At the completion of the Tamiami Trail in 1928 the machine was stored at the intersection of US41 and FL 92. Mr. Meece Ellis bought the parcel of land at that intersection and established a filling station, restaurant and motel business which still exists. Later the dredge was moved to the adjacent County Park. In 1947 the Collier-Seminole State Park was created from the County Park and the dredge remained as a permanent exhibit. Bay City Walking Dredge No. 489 is the last known dredge of its type. It was attacked by Hurricane Andrew during August 1992 but survived undamaged.

FIG. 5–THE BAY CITY WALKING DREDGE IN THE TROPICAL SETTING OF COLLIER-SEMINOLE STATE PARK.

The Bay City Walking Dredge No. 489 is the 108th National Historic Mechanical Engineering Landmark to be designated. Since the ASME History and Heritage Program began 160 Historic Mechanical Engineering Landmarks, 6 Mechanical Engineering Heritage Sites, and 4 Mechanical Engineering Heritage Collections have been recognized. Each reflects its influence on society, either in its immediate locale, nationwide, or throughout the world.

An ASME landmark represents a progressive step in the evolution of mechanical engineering. Site designations note an event or development of clear historical importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The ASME Historic Mechanical Engineering Recognition Program illuminates our technological heritage and serves to encourage the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers, and helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

ACKNOWLEDGEMENTS

1. The files of Collier-Seminole State Park, Florida.
2. *The Bay City Land Dredge Works: Perspectives on the Machines of Land Drainage,* by Prof. John Thompson appearing in the Michigan Historical Review, Fall 1986.
3. *The Engineering of Excavation,* by George B. Massey, 1923.
4. *Across the Everglades with the Trail Builders,* by Col. Frank F. Tenny, Jr. appearing in the Collier County Heritage, 1976.
5. George Underwood of Cape Coral, Florida for the CAD generated drawings and the explanation of how the dredge walks.
6. An interview with D.E. (Doc) Johnson by Brian L. Polk, 1984.
7. Parts List and Specifications for Walking Dredge No. 489, Brett, Inc., Turner, Michigan.
8. Alfred Kurzenhauser, Secretary, Region XI Opr. Board, whose firm (Superior Printing, Tampa, FL) published this brochure.
9. Peter D. Brockmann, Park Ranger, Collier-Seminole State Park, for his enthusiasm, knowledge and patience.

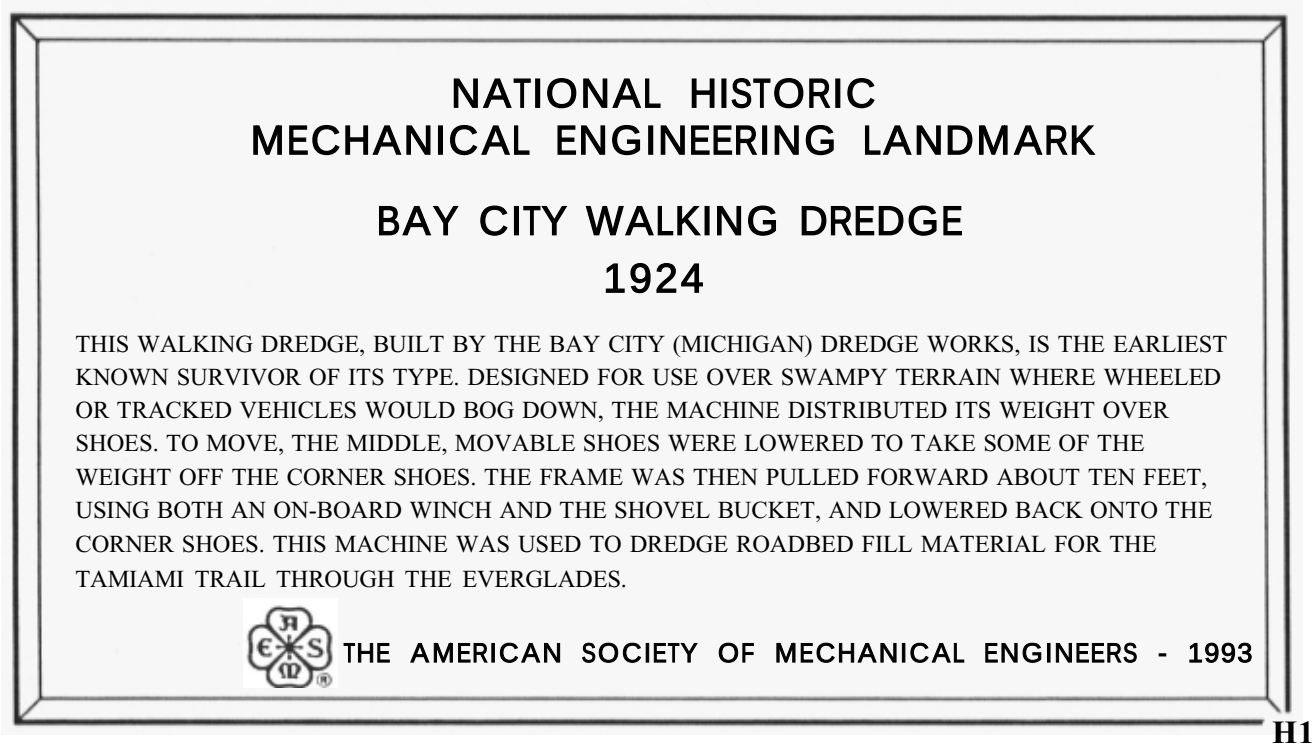


FIG. 6-ASME PLAQUE