



**INTERNATIONAL MASONRY INSTITUTE DEMONSTRATES
'MAMA,' A NEW MECHANICAL DEVICE TO LIFT HEAVY
MASONRY UNITS, REDUCE STRAIN AND FATIGUE**

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ABSTRACT

The International Masonry Institute (IMI) has developed and demonstrated a prototype of a new, electronically controlled mechanical device it is calling a Mechanically Assisted Mason's Aid, or "MAMA," that enables bricklayers to easily lift, handle and set into walls masonry units that weigh up to 90 pounds each. The device is especially useful for laying of block walls where the masonry units are heavier than a worker can reasonably handle.

INTRODUCTION

The MAMA device was developed jointly by IMI and the U.S. Army Construction Engineering Research Laboratory (CERL). IMI and CERL have been developing the device for several years, and have patents pending.

The prototype, which, from a distance, resembles a small crane, was designed to greatly reduce bricklayer fatigue and the number of work-related muscular injuries and strains bricklayers suffer. It is used in combination with existing lift scaffolding common in masonry wall construction. The MAMA device is moved upwards along the scaffolding as the wall rises, and is capable of substantial lateral movement.

The device is directly controlled by bricklayers, who use it to lift masonry units from the ground or from scaffolding to their place on the wall under construction. A single bricklayer can operate the device with one hand while he works a trowel with the other. A two man crew of bricklayers can also work efficiently with the device. The prototype MAMA can handle block or other masonry units that weigh up to 90 pounds each. Its

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mechanical advantage is such that a 90-pound masonry unit feels as if it weighs only four pounds to a bricklayer. The device relies primarily on manual manipulation from the bricklayer, provides safety braking on all pivot axis and along a trolley track and provides for powered raising and lowering of a hoist for picking up and depositing concrete masonry units in a mortar bed.

The accompanying photographs depict a prototype that is larger and slower than a production version will be. The prototype was built heavier than it had to be, and it hasn't been optimized for operator speed. MAMA was developed to prove that it was possible to design and build a device that would help bricklayers avoid many of the strain injuries involved in their work.

Most bricklayers will be able to work efficiently with a MAMA device after no more than a half-day of training and hands-on experience. In limited demonstrations to date, a number of journeymen bricklayers quickly figured out the "rhythm" of working efficiently with the device and other bricklayers took a little longer.

From a marketing point of view, the device will appeal to mason contractors who are involved in the construction of commercial buildings, such as warehouses, shopping centers, supermarkets and factories with long, straight walls. MAMA is attached to the lift scaffolding used in constructing the walls of these kinds of structures.

With MAMA, a journeyman bricklayer can lift a 90-pound concrete block with one hand while he has a trowel loaded with mortar in the other hand, and then apply the mortar and place the block precisely where he wants it on the wall in smooth, efficient motions without worrying about straining his back or legs.

IMI notes that contractors and bricklayers alike have been calling for a device like MAMA for years because it can increase the worklife of journeymen. Building block walls is strenuous. Commercial-size masonry units are heavy, and lifting them to the wall eight hours a day takes its toll in muscular strains. When you reduce strain and fatigue, you extend the productive work life of the masons and you help the contractor keep qualified workers on the job longer.

The device may provide other productivity gains. It may speed up construction because it will enable larger and heavier masonry units to be set into walls, thus reducing the total number of units.

OPERATION

The MAMA apparatus is mounted to a track that is attached to the movable deck of commercial lift scaffolding. It raises and lowers a concrete masonry unit gripping device suspended on a cable. A journeyman mason operates the device from a control system mounted on a U-shaped handle attached to the gripper. Using one hand, he slides the

gripper into the open web of a concrete block and, using electromechanical controls, tightens it so the gripper will not slip. The bricklayer then guides the MAMA in the lifting and placing of the concrete block into the bed of mortar awaiting it on the wall under construction. The control system has sensing devices that provide continuous, smooth response to low-force guidance from the bricklayer, and numerous safety features. When a concrete block is eased into its mortar bed, the cable slackens and the gripper can be opened by means of a gripper control button. The device will not allow its gripping tool to release a load if there is a power failure, or if the release button is unintentionally actuated, but only if the load is placed on a firm base.

A “dead man’s switch” senses the bricklayer’s hand at the control. The switch must be actuated in order to provide for any power movement and to permit release of brakes on the pivot axis and on the trolley assembly. Whenever the dead man’s switch is released, indicating that the bricklayer is not controlling the device, all brake axis and the hoist lift are locked.

MAMA works off of a 120-volt AC electrical source, which it converts to 24 volts DC. The gripper activating mechanism on the prototype comprises an electrical power means which is driven by a controller. The mechanical grip mechanism may be a screw assembly driven by a motor or any similar mechanism. A hydraulic gripper can be used as an alternative. The device meets all applicable U.S. Occupational Safety and Health Administration (OSHA) standards.

The device is capable of movement horizontally along a trolley track connected to a scaffold system. The bricklayer can move the device along the track by commanding a release of the trolley track brakes and by pushing it in the desired direction along the track. A microprocessor provides for selective locking and unlocking of pivot arms, trolley track brakes, opening and closing of the gripper jaws and response to operator commands received from the operator control handle. Locking the brakes allows safe movement of the gripper without any movement along the trolley track.

The continuous trolley track is required to move the MAMA device along the length of a scaffold assembly. Scaffolds, for the most part, are erected in a less than perfect manner, and therefore it is necessary to provide within the device’s trolley track assembly sufficient mechanical allowance for misalignment of scaffold assemblies. The trolley track can extend in a horizontal direction to bend or twist at each scaffold support point. It provides for sufficient flexibility so that one section of the scaffold can be raised while another is stationary.

DEVELOPMENT CONTINUES

MAMA is still under development. When it has been fully tested and modifications have been made in the light of testing experience, IMI plans to license an industrial equipment manufacturer to produce a saleable version and market it.

Operational Capabilities Mechanically Assisted Mason's Aid

The Mechanically Assisted Mason's Aid was designed to place Heavy Concrete Masonry Units (HCMU) with the following characteristics:

	MINIMUM	MAXIMUM	IAW
Aspect Ratio	1.3/1	2.5/1	ASTM C90
Width, Height	8"	14"	ASTM C145
Length, O.L.	8"	24"	
Stiffness		Rigid	
Weight	30 pounds	90 pounds	

The Mechanically Assisted Mason's Aid performs to the following specifications:

System Electrical Requirements	1/60/110 VAC, 20 AMP. G.I. Protection
Maximum Cycle Rate (MCR)	2 in./sec., rate, 50 cycles an hour
Operator's Station	Bi-handed, right or left hand operation
Allowable Maintenance Time	0.02/elapsed Run Time
Environmental Operating Range	Outdoors, 30° to 110°F, rain, snow, ice
Safety Requirements	IAW All OSHA/NIOSH/ANSI Requirements
Mast/Platform Loading	750 lbs.
Max/Mast Moment Loading	3000 ft.-lbs.
Availability Time (AT)	0.97/time
Continuous Run Time (CRT)	08/16 hours
Operational Hour Life	20,000 hours (a 10-year life)
Enclosure/Housing	NEMA 4 Min.
Work Envelope	330° Tore Shape Continuous Track, Dead Space 60 in. DIA
Layout/Installation	Maximum flexibility/Modular/Expandable
Interfaces	IAW Masons' Operations and Functions and Currently Used Equipment, such as Morgen Scaffolding
Ergonomic Requirements	Accommodate male and female masons to the 90 percentile

Table 1

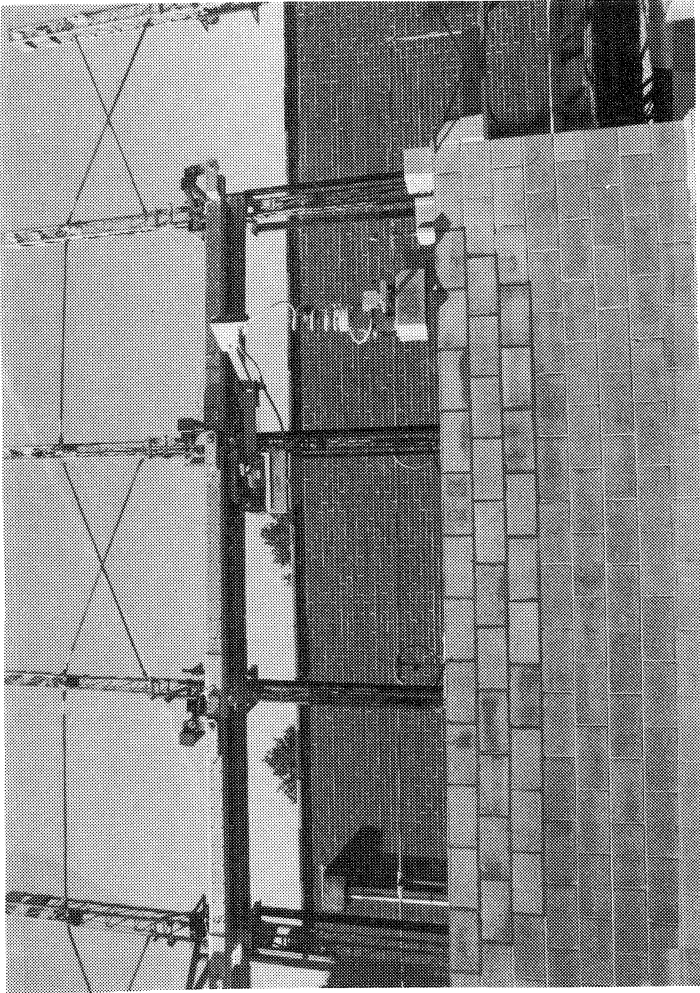


Fig. 1 IMI's Mechanically Assisted Mason's Aid, unattended and locked for safety. Note the Trolley Track above the device and perpendicular to the Lift Scaffolding Columns.

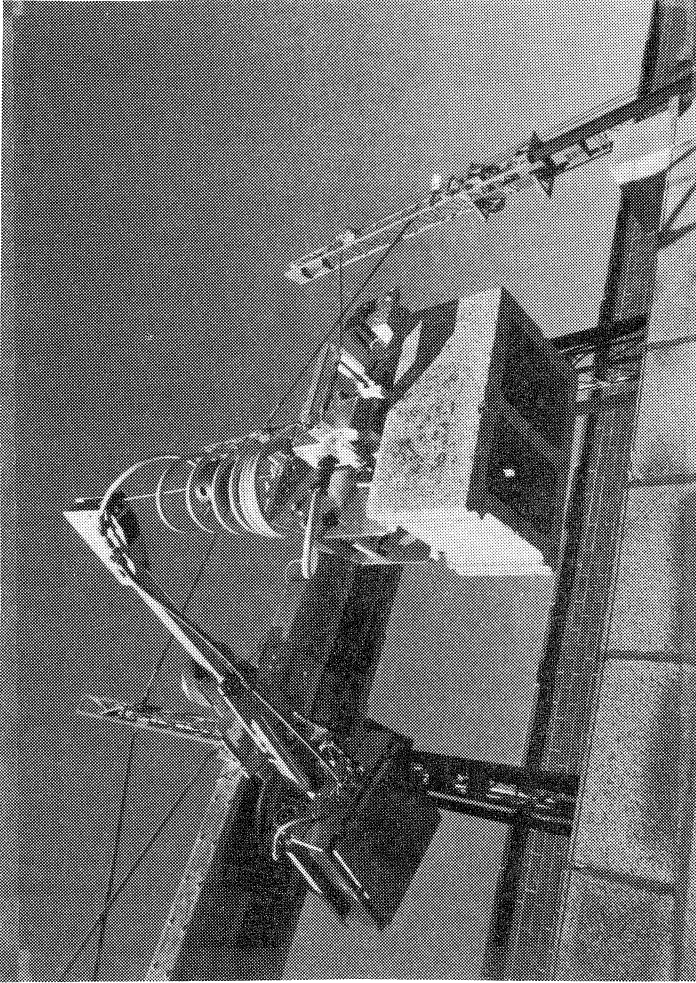


Fig. 2 A close-up of MAMA's Hoist and Gripper Assemblies. The gripper, a prototype, is significantly larger than a production unit would be.

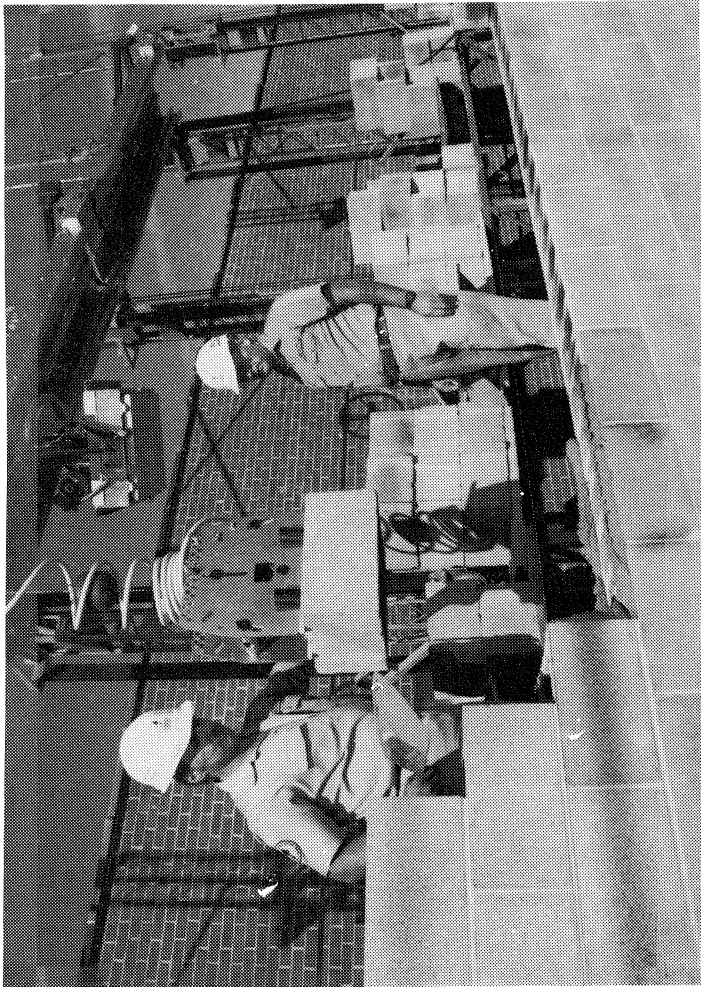


Fig. 3 One Man Operation is Practical with MAMA. Here, a journeyman bricklayer manipulates the gripper to lower a concrete block onto a mortar bed he has prepared. Because of Mechanical Advantage provided by the Hoist, this 50-pound block feels as if it weighs four pounds to the bricklayer.



Fig. 4 A Two Man Crew can work Quickly and Efficiently with MAMA. Here, one bricklayer lowers a concrete block into position while the other loads his trowel with mortar.

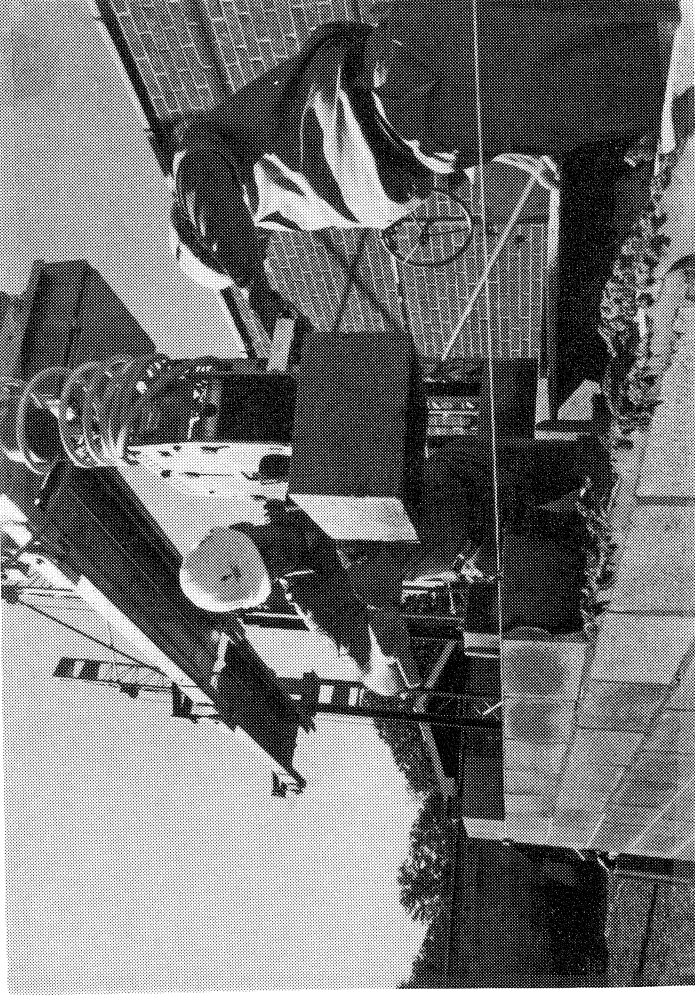


Fig. 5 Now one bricklayer is buttering the block while the other manipulates the gripper through its control handle.

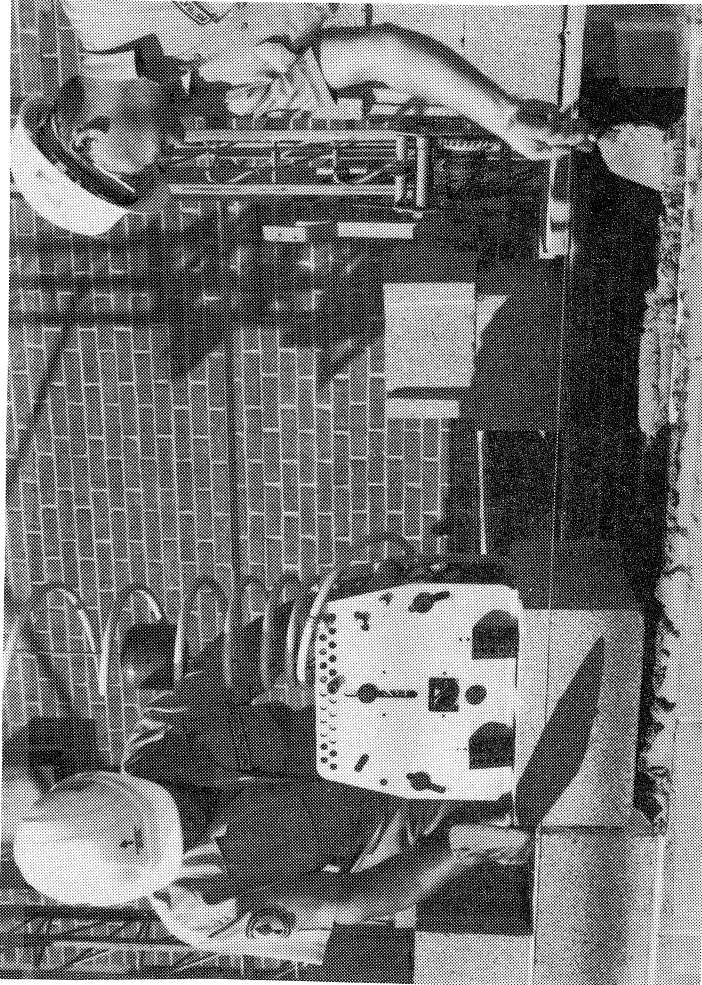


Fig. 6 Placement of the concrete block is nearly complete. Note that the second bricklayer is preparing the mortar bed for placement of additional block.