United States Patent [19]

Kalns

[11] **3,826,411**

[45] **July 30, 1974**

[54] **CONCRETE SLAB FORMING MACHINE WITH HIGH EXTRUSION CAPACITY**

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[52] **U.S. Cl.** **222/235,** 222/346, 425/209, 425/447

[51] **Int. Cl.** **G01f 11/02**

[58] **Field of Search** 222/234, 235, 345, 346, 222/409, 372; 417/209, 218, 59, 447; 425/209, 447

[56] **References Cited**

UNITED STATES PATENTS

2,095,509	10/1937	Merchen	222/409 X
2,388,805	11/1945	Stahl	222/409 X
3,143,782	8/1064	Kalns	425/218

FOREIGN PATENTS OR APPLICATIONS

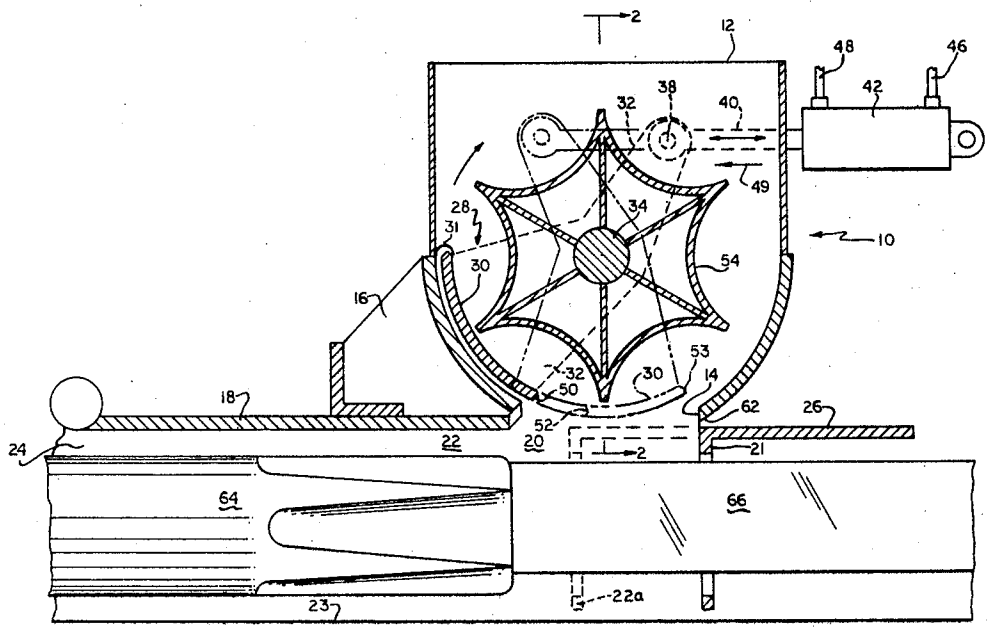
543,479	10/1955	Italy	425/209

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[57] **ABSTRACT**

During a ram stroke, a ram plate forces a concrete mix from a ram chamber into a slab forming cavity and a gate member closes to isolate the ram chamber from a supply hopper. The supply hopper includes a rotary feeder having a hypocycloid cross section for transporting the concrete mix through the hopper to the ram chamber.

2 Claims, 2 Drawing Figures



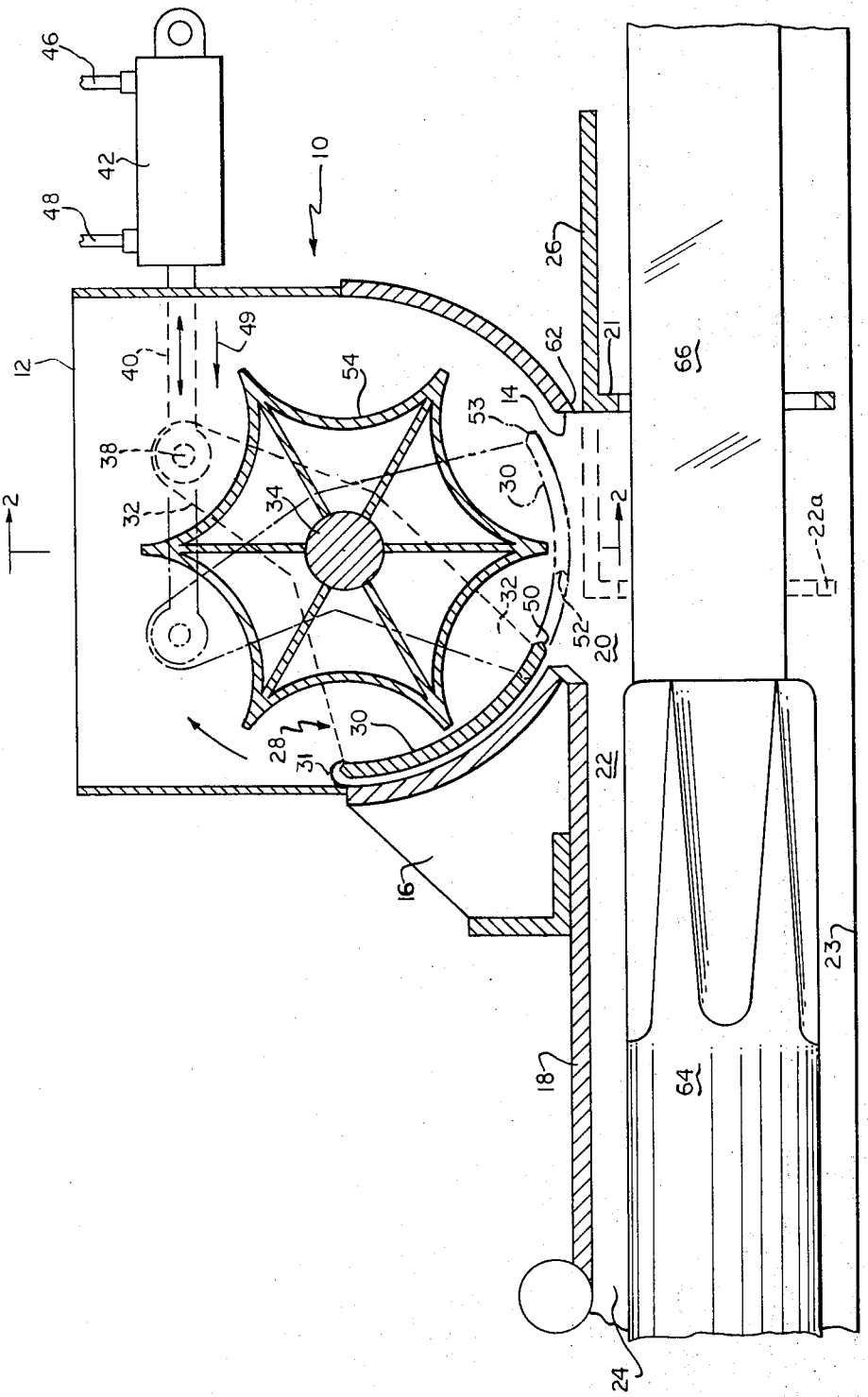

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Fig. 1

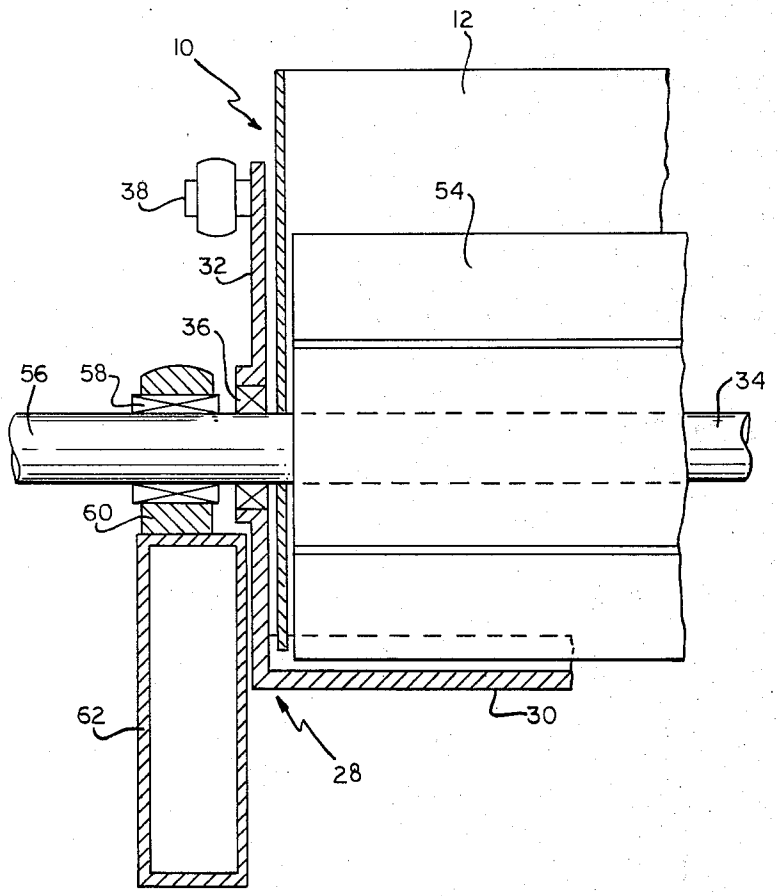


Fig. 2

CONCRETE SLAB FORMING MACHINE WITH HIGH EXTRUSION CAPACITY

BACKGROUND OF THE INVENTION

This invention relates to the extrusion of concrete, and more particularly to apparatus for efficiently extruding concrete slabs.

A concrete slab produced by the apparatus of the invention and used for the construction of walls and floors of buildings normally has a minimum thickness of six inches and has therethrough a plurality of evenly spaced cylindrical holes with axes parallel to the faces of the slab. Providing the holes reduces the weight and material cost of the slab.

As is known to those skilled in the art, concrete has a high compression strength and a low tensile strength. Typically, embedded within the slab are steel rods aligned in a direction parallel to the axes of the holes whereby the tensile strength of the slab is increased. Additionally, the rods may be kept in tension while the concrete of the slab solidifies, whereby the slab is in compression when the tension is removed. The compression further increases the tensile strength of the slab.

The slabs described hereinbefore are produced by either wet casting or extrusion. In wet casting, a wet concrete mix is placed in a mold containing the steel rods and forms for forming the cylindrical holes; when the concrete solidifies, the forms are removed.

Extruding the slabs is more economical than wet casting because forms are eliminated and labor cost reduced. Thus, an almost dry concrete mix is used in an extrusion machine which extrudes an almost solidified slab. A concrete extrusion machine disclosed by Kalns in U.S. Pat. No. 3,143,782 typically provides extruded slabs of about 4 feet wide and of any desired length. In the commercial application of the Kalns machine the extruded slab can have any desired length and can be cut by a cutting machine to provide slabs of the length required for construction.

The Kalns machine is comprised of a supply hopper through which the concrete mix is fed onto a floor surface in a ram chamber between a ram plate and the inlet of a forming cavity enclosed by a pair of side members, a floor surface and a top member. The ram plate is coupled to a hydraulic actuator which provides a force for forcing the plate towards the inlet (referred to as a ram stroke, hereinafter), thereby forcing the concrete mix into the forming cavity and forcing extruded concrete from the distal end thereof upon the floor surface. The machine moves on rails away from the extruded concrete at the speed of the extrusion thereby forming a slab extending along the path of the machine, between the rails. The cylindrical holes referred to hereinbefore are provided by a plurality of cylindrical mandrels within the forming cavity extending from the inlet to the distal end. The steel rods may be embedded by the alignment thereof between the rails prior to the extrusion.

In the Kalns machine, the ratio of the length of an extrusion, in response to a ram stroke, to the length of the ram stroke (about 0.4–0.5) is a measure of the stroke efficiency of the machine. The stroke efficiency is related to the rate at which the machine extrudes concrete (extrusion capacity). It has been found that the extrusion capacity of the Kalns machine can be improved by increasing the stroke efficiency, increasing the quantity of the concrete mix fed into the ram chamber and increasing the number of ram strokes provided during a fixed period of time.

Since continuing commercial success of concrete extrusion machines is related to their capacity, a need exists for machines having a higher capacity than heretofore known in the art.

SUMMARY OF THE INVENTION

The principal object of the present invention is to provide improved Kalns machines which have a high extrusion capacity.

According to the present invention, in a machine of the type disclosed by Kalns, a gate is positioned between the supply hopper and the ram chamber during each ram stroke of the machine.

In further accord with the present invention, a rotary feeder having a generally hypocycloid cross section is rotatably mounted between side walls of the supply hopper of a machine of the type disclosed by Kalns.

The present invention provides improved Kalns machines where the discharge hopper is isolated from the ram chamber during at least a portion of the ram stroke thereby increasing the stroke efficiency of the machine. An improved feeder in the discharge hopper increases the rate at which a concrete mix can be fed into the ram chamber of the machine.

Other objects, features and advantages of the present invention will become more apparent in the light of the following detailed description of a preferred embodiment thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation, partly in section, of the preferred embodiment of the present invention; and

FIG. **2** is a sectional view along the line **2—2** of FIG. **2** looking in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1,** the improved Kalns machine of the invention is comprised of a supply hopper **10** open at its upper end **12** and having an outlet port **14** in its lower end. The hopper **10** includes a support section **16** which is fixedly mounted upon a top plate **18.** In the disposition of the hopper **10,** the output port **14** is disposed above a ram chamber **20** and in the preferred embodiment, a cement mix is fed into the ram chamber from the hopper **10** via the outlet port **14.**

At predetermined time intervals, a vertical ram plate **21** is moved through the chamber **20** towards the inlet end of a slab forming cavity **22** which is enclosed by a floor surface **23,** the top plate **18** and side plates **24** of the machine. The cement mix in the chamber **20** is thereby forced into the cavity **22** by a ram stroke of the ram plate **21.** The dash lines **22*a*** indicate the approximate position of the ram plate **21** at an intermediate point of its stroke. The cement mix forced into the inlet end of the cavity **22** forces extruded concrete from the distal end thereof (not shown). After the ram stroke, the ram plate **21** is retracted back through the chamber **20,** more concrete mix is fed from the hopper **10** and the ram stroke is repeated.

A horizontal ram plate leg **26,** integral with the ram plate **21,** is connected to the piston of a hydraulic ram

plate actuator (not shown). In response to hydraulic fluid being admitted into the extrusion end of the actuator, ram plate **21** is moved toward the cavity **22** thereby providing a ram stroke. In response to fluid being admitted into the retraction end of the actuator, the ram plate **21** is retracted.

In the present invention, during a ram stroke a closure gate member **28** having an arcuate blade **30** isolates the chamber **20** from the hopper **10.** The blade **30** prevents any portion of the concrete mix in chamber **20** from being forced back into the hopper **10** by ram plate **21.**

The arcuate blade **30** of gate member **28** extends at a right angle from the lower end of an external operating arm **32** having the general shape of a bell crank, the blade extending into the hopper through a slot **31.** Blade **30** is positioned in the hopper **10** for pivotal movement about the axis of curvature of the blade. To this end, the member is rotatably mounted on an axle **34** by means of a bearing **36,** FIG. **2.** A coupling pin **38** extends outwardly from the upper end of the arm **32,** and this pin is connected to the piston rod **40** of a hydraulic gate actuator **42,** FIG. **1.**

The gate actuator **42** has hydraulic lines **46, 48** connected thereto. In response to fluid being admitted to the actuator through line **46,** the actuator piston causes rod **40** to move in the direction indicated by arrow **49** whereby blade **30** substantially closes the port **14.** In response to fluid entering the gate actuator **42** through the line **48,** the rod **40** moves in the opposite direction whereby the arm **32** and blade **30** move to open the port **14.** The lines **46, 48** are connected to admit hydraulic fluid simultaneously with the respective admissions of fluid to the extrusion and retraction ends of the ram plate actuator. Therefore, the blade **30** only closes the port **14** during a ram stroke.

In the preferred embodiment, the stroke efficiency of the Kalns machine is substantially increased when the port **14** is either closed or partially closed during a ram stroke. At the very beginning of the ram stroke, the leading edge **50** of the blade **30** may move, for example, to a point **52;** at the end of the ram stroke, the edge **50** may move to a point **53.** When the blade **30** only moves to point **52,** the hopper **10** is isolated from the chamber **20** towards the end of the ram stroke. The concrete mix in the chamber **20** at the beginning of the ram stroke is compressed at the end of the ram stroke within a reduced volume between the ram plate **22** and the cavity **24.** Accordingly, during the end of the ram stroke some of the concrete mix may be pushed towards the hopper **10,** against the blade **30** which prevents the concrete mix from being forced back into the hopper **10.** Therefore, isolation of the hopper **10** from the chamber **20** towards the end of the ram stroke increases the stroke efficiency more than isolation at the beginning of the ram stroke.

Within the hopper **10,** a rotary feeder **54** having a generally hypocycloid cross section is fixedly mounted upon the axle **34.** The concrete mix is provided through the upper end **12** to troughs between the cusps of the feeder **54.** In response to rotation of the axle **34,** the concrete mix is fed through the outlet port **14** into the chamber **20.** The feeder **54** provides feed of the concrete mix to the chamber **20** during the feed cycle.

One end **56** (FIG. **2**) of the axle **34** is journalled in a bearing **58** in an upstanding member **60** supported by a side plate **62.** The end **56** may be connected to any suitable source of rotary power to rotate the feeder **54.**

Referring again to FIG. **1,** a knife edge **62** may be provided to scrape concrete mix from the leg **26** during the ram stroke and the retraction, thereby substantially preventing a buildup of cement on the leg **26.**

A mandrel **64** is supported within the cavity **22** by a support arm **66.** A plurality of mandrels and support arms are typically included within the Kalns machine for providing holes along the length of an extruded slab as disclosed in U.S. Pat. No. 3,143,782.

Thus there has been shown an improved Kalns machine wherein the supply hopper **10** is isolated from the ram chamber **20** during the ram stroke and a rotary feeder **54** provides the concrete mix through the hopper **10** during the feed cycle. Accordingly, the improved machine has a higher extrusion capacity than machines heretofore known in the prior art.

Although the invention has been shown and described with respect to a preferred embodiment thereof, it should be understood by those skilled in the art that various changes and omissions in the form and detail thereof may be made therein without departing from the spirit and the scope of the invention.

I claim:

1. In a concrete extrusion machine of the type in which a concrete mix is fed from a hopper by a feeder mounted on an axle in the hopper to a ram chamber during the retraction of a ram plate, the ram plate being moved during a ram stroke from its retracted position through the chamber to force at least a portion of the concrete mix into an extrusion cavity, the hopper communicating with the ram chamber through an opening therebetween, the improvement comprising: a movable closure member for said opening, the closure member including a blade disposed within the hopper for swingable movement therein and an operating arm pivotally supported by said axle, the blade being secured at one end to the operating arm, and means responsive to a ram stroke to pivot the operating arm so that the blade at least partially closes the opening during a portion of the ram stroke.

2. A machine as defined in claim **1** wherein said hopper mounted feeder has a generally hypocycloid cross section.

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