

No. 763,559.

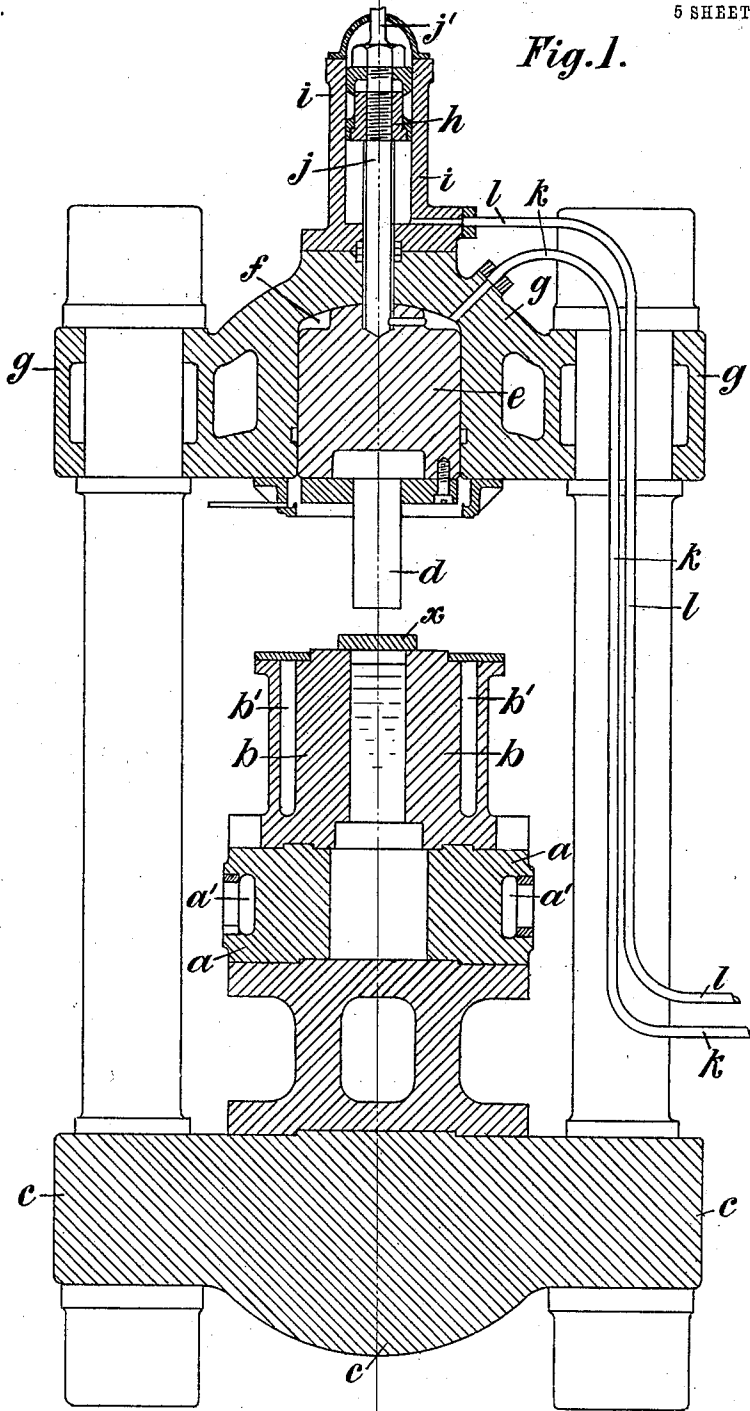
PATENTED JUNE 28, 1904.

G. E. HEYL-DIA & A. MUSKER.
METAL EXTRUSION APPARATUS.

APPLICATION FILED JAN. 27, 1902.

NO MODEL.

5 SHEETS—SHEET 1.



WITNESSES:

Isabella Waldron
Oldman

INVENTORS

George Edward Heyl-Dia
Arthur Musker
BY *Richardson*
ATTORNEYS

No. 763,559.

PATENTED JUNE 28, 1904.

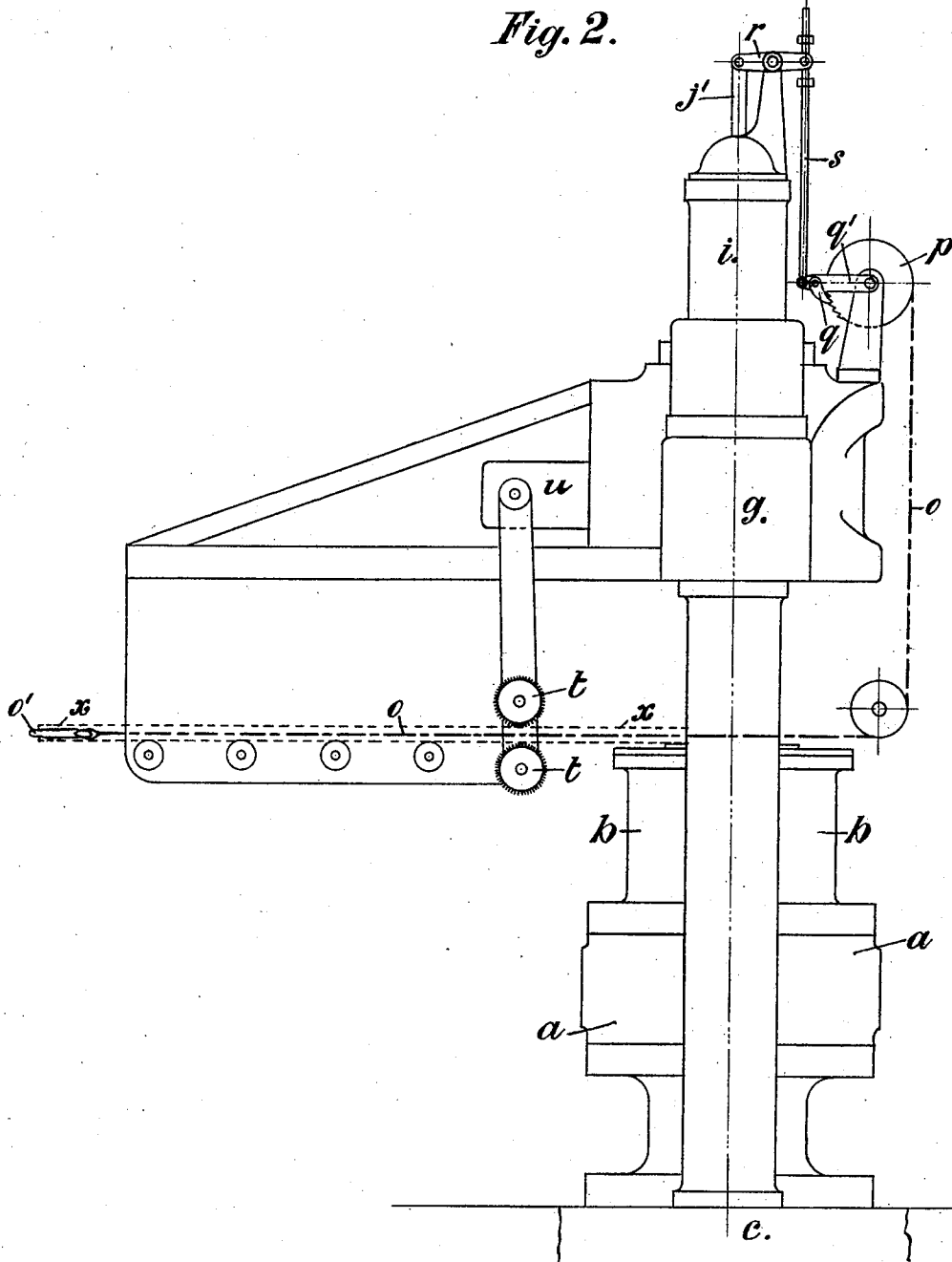
G. E. HEYL-DIA & A. MUSKER,
METAL EXTRUSION APPARATUS.

APPLICATION FILED JAN. 27, 1902.

NO MODEL.

5 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

Isabella Kaldron

Edmund

INVENTORS:

George Edward Heyl-Dia
Arthur Musker

BY *Richardson*

ATTORNEYS

No. 763,559.

PATENTED JUNE 28, 1904.

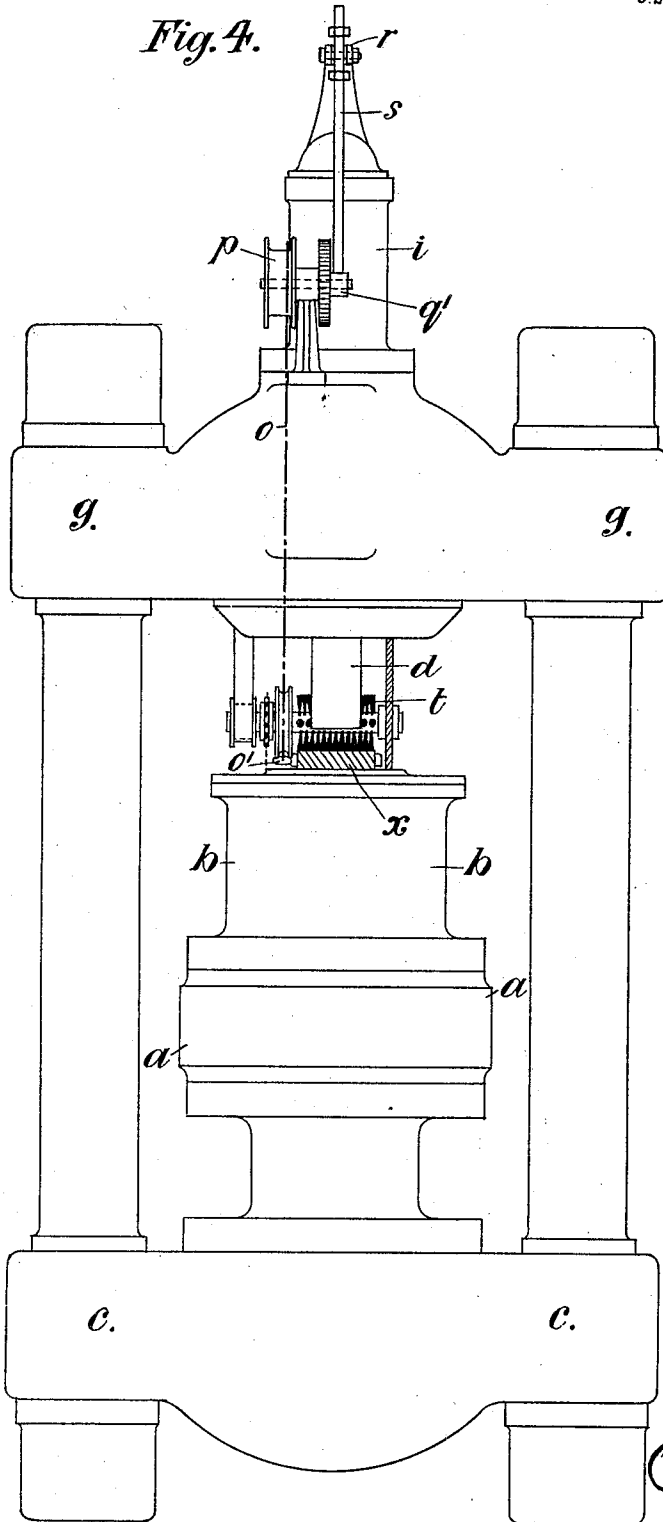
G. E. HEYL-DIA & A. MUSKER.
METAL EXTRUSION APPARATUS.

APPLICATION FILED JAN. 27, 1902.

NO MODEL.

5 SHEETS—SHEET 4.

Fig. 4.



WITNESSES
N. M. Kuehne
John A. Parnal

INVENTORS
George Edward Heyl-Dia
Arthur Musker

By *Richardson*
 ATTORNEYS

No. 763,559.

PATENTED JUNE 28, 1904.

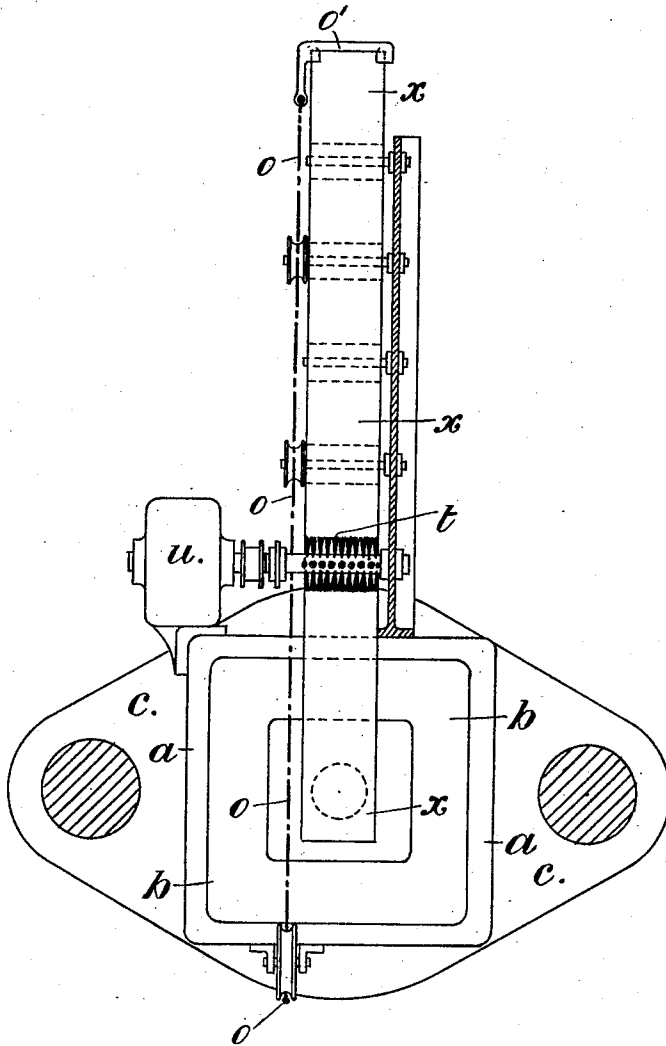
G. E. HEYL-DIA & A. MUSKER.
METAL EXTRUSION APPARATUS.

APPLICATION FILED JAN. 27, 1902.

NO MODEL.

5 SHEETS—SHEET 5.

Fig. 5.



WITNESSES

H. M. Kuehne
John A. Percival

INVENTORS

Serge Edward Heyl-Dia
Arthur Musker

BY *Richard R.*
ATTORNEYS

UNITED STATES PATENT OFFICE.

GEORGE EDWARD HEYL-DIA, OF WARRINGTON, AND ARTHUR MUSKER,
OF LIVERPOOL, ENGLAND.

METAL-EXTRUSION APPARATUS.

SPECIFICATION forming part of Letters Patent No. 763,559, dated June 28, 1904.

Application filed January 27, 1902. Serial No. 91,518. (No model.)

To all whom it may concern:

Be it known that we, GEORGE EDWARD HEYL-DIA, engineer, a resident of Warrington, and ARTHUR MUSKER, engineer, a resident of Tuebrook, Liverpool, in the county of Lancaster, England, subjects of the King of England, have invented certain new and useful Improvements in or Connected with Metal-Extrusion Apparatus, of which the following is a specification.

This invention has reference to the manufacture of metal pipes, rods, and the like by the extrusion process—that is, by forcing such metal by suitable pressure, generally hydraulic pressure, from a forming die or dies on the apparatus.

According to this invention the metal is forced from the extrusion-die by a suitable hydraulic ram, and the metal is fed to the metal-receiver and melting part intermittently by a forcing-feed device which presses a certain-sized piece or quantity of metal each stroke into the metal-container. In some cases the metal is solid, (cold or hot,) and solid pieces are thus forced into the receiver, while in another case the metal may be in a liquid state and forced in. The hydraulic-pressure ram moves up and down and works at a pressure according to the nature of the metal to be squirted or extruded into pipes or rods, and the metal is fed to the receiver during the interval between such strokes. The rapidity of the stroke regulates the speed of the squirting or extruding process. The feeding action is thus, so to speak, intermittently continuous, and the squirting process is practically continuous also. Further, according to this invention in a hydraulic extrusion apparatus for the manufacture of pipes, rods, or the like the metal-receiver and die-box are stationary, and above is a hydraulic ram or apparatus which is fixed in a suitable manner—say in the central position—above the metal-receiver and other parts, and by the ram of this hydraulic apparatus the pressure is ex-

erted on the metal to be squirted or extruded.

The invention the nature of which is above described is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation in section, showing the improved apparatus; and Fig. 2 is a side elevation. Fig. 3 is a detail view showing the dies and the exit of the completed article, said section being taken vertically and centrally of Fig. 1. Fig. 4 is a front view of the apparatus, partly in section. Fig. 5 is a plan view, partly in section.

Referring now to the drawings, *a* is the die-box, and *b* is the metal-receiving box, into which the metal to be extruded or squirted into tubes, bars, or the like is fed in the intermittent continuous manner above referred to. This die-box and receiver are supported upon a base *c* at the bottom of the press and are stationary thereon.

d is the metal-feeding punch-plunger, by which the intermittently continuous supply of metal is forced into the receiver *b*, and *e* is a hydraulic ram disposed and working in the cylinder *f* in the head *g* of the press and carrying the punch-plunger *d* down. The ram *e* presses the punch-plunger *d* down and gives it its active stroke, while its return stroke is effected by a piston *h*, working in a cylinder *i* on the top of the press-head *g* and connected with the ram *e* by the rod *j*. Pressure-water is distributed to and from the cylinders *f* and *i* by inlets *k* and *l*, respectively, the supply and exhaust being controlled by suitable controlling-valves.

The bar of lead or other metal *x* to be fed and supplied to the receiver *b* is intermittently fed under the punch-plunger *d* when it has been raised out of the receiver *b*, and this is preferably automatically effected, as hereinafter described, and as it is fed forward its surfaces are cleaned by the action of wire revolving brushes *z*, one on either side of it, these brushes being revolved by an electro-

motor *u*, or these surfaces may be cleaned by scraping or other suitable means.

The receiving vessel or cylinder *b* and the die-box *a* are heated externally by introducing superheated steam or hot gases of combustion through jackets *b'* and *a'*, respectively, which surround them, in any known suitable way, and as the metal is forced by the punch-plunger *d* down through the receiver *b* to the die-box *a* it is brought to a plastic or semisolid mass, as hereinafter described.

The general action of the apparatus is as follows: Assuming the press to be in operation and the receiver *b* and die-box *a* to be full of metal—say lead—and the process of extruding or squirting is being carried on, the punch-plunger *d* will be alternately pressed down into the receiver *b*, which is a cylinder, and moved up out of it by the rams *e* and *h*, respectively, by hydraulic pressure. After each withdrawal of the punch-plunger *d* from the receiver *b* the lead bar *x* is fed forward over the mouth of the container *b* by the feeding or moving apparatus hereinafter described, and then in the next descending action the punch-plunger *d* punches a disk or slab of lead out of the bar *x* and forces it into the receiver-cylinder *b* and to a depth about equal to the thickness of the disk or slab. In this action not only does the punch-plunger punch out the disk or pellet and press it into the receiver, but it also extrudes or squirts metal out through the die and produces a certain length of tube or bar, and it presses the disk or pellet down so far into the receiver as to leave a depth of space at the top which is about equivalent to the thickness of the slabs. The action, therefore, of the rams and feeding punch-plunger is a reciprocating one, producing an intermittent continuous feed and a concomitant intermittent continuous squirting or extruding action, and the extruded pipe or rod in a solid state is produced without showing any joint-marks or like markings, and the only interval in the squirting is during the time the plunger is in its withdrawing stroke and the first portion of the downstroke. By this mode of pressing the successive lead disks or pellets by the pressure of the hydraulic forcing-ram into the receiver *b* one upon another and by heating the die-box *a* and receiver *b* externally, as described, the separately-superposed disks or pieces as they descend into the receiver become united into one semisolid mass without joints and arrive in the die-box *a* in this condition.

With regard to the feeding of the solid metal bar *x* under the punch-plunger the mechanism for accomplishing this (shown in the drawings) consists of a chain or cord *o*, with a hook or catch *o'* at one end, adapted to

engage with the back end of the bar *x*, the other end being fixed to a winding-barrel *p*, operated by a reciprocating pawl *q*, mounted on the lever *q'* and operated by the extension *j'* of the piston-rod *j* of the cylinder *i* through a beam or lever *r* and a rod *s*, connecting *r* with the lever *q'*.

The expression "intermittent continuous" means that the process is continuous except in so far as the squirting of the lead temporarily ceases during the upstroke of the plunger; but nevertheless the lead sheath does not show any work due to this cessation, but appears to have been continuously produced.

The bar *x* is not wound upon the barrel *p*, but only the pulling-chain *o*. With regard to the means of propelling the bar *x* under the punch *d* this bar is propelled, as described, by the hook *o'*, which lies behind or at the back edge of the bar *x*, and this hook is pulled by the chain *o*.

Referring to Fig. 3, the dies *a³* and *a⁴* are fitted in an opening *a⁶* of a holder *a²*, arranged in the metal receiving and containing box *b*, the said dies shown being of the kind usually employed for covering cables. The cable is introduced through the right-hand die *a³* and becomes coated with the lead issuing from between the dies. The lead is supplied to the dies through an annular channel *a⁷* from the interior of the receiving and containing box.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a metal extrusion or squirting machine, the combination of a metal-receiver, a plunger having a continuous reciprocating action working in connection with the open end of said receiver, a bar of metal adapted to be moved or fed over the open mouth of the receiver, and wire cleaning means adapted to act on the surface of said metal bar as it is moved or fed forward to the machine; substantially as set forth.

2. In a metal extrusion or squirting machine, a chamber open at the upper end adapted to receive at said open upper end the metal to be extruded or squirted, a plunger having connected with it a die through which the metal is extruded or forced; a plunger or plungers having a continuous reciprocating action at said open end, and working in connection therewith, a ram disposed above and carrying said punch, a press-head having a cylinder in which said hydraulic ram works, and means for propelling a bar of metal over the open end of the receiver.

3. In a metal extrusion or squirting machine, the lower stationary metal-receiver *b*; and die-box *a*; a reciprocating plunger *d* disposed above the receiver *b*; a ram *e*; a cylinder *f* in the head *g* of the machine in which

the ram *e* works; a cylinder *i* above the cylinder *f*; a piston *h* therein connected with the ram *e* by the rod *j*; a winding-barrel *p* operated from the piston *h*; and a chain or rope
5 *o*, connected with the metal bar to be moved, and the winding-barrel *p*; substantially as set forth.

In witness whereof we have hereunto set our hands in presence of two witnesses.

GEORGE EDWARD HEYL-DIA.

ARTHUR MUSKER.

Witnesses:

ERNEST R. ROYSTON,

JOHN H. WALKER.