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Eyberger

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[54] **SELF-CONTAINED FEED ROLL FOR POWER PUNCH PRESSES**

[75] Inventor: **Harry Eyberger**, Pittsburgh, Pa.

[73] Assignee: **Vamco Machine and Tool, Inc.**, Pittsburgh, Pa.

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Related U.S. Patent Documents

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[52] **U.S. Cl.** **83/245**; 83/202; 83/228; 226/154

[58] **Field of Search** 83/202, 228, 245, 261, 83/253; 226/154–156

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Primary Examiner—J. M. Meister
Attorney, Agent, or Firm—Stanley J. Price, Jr.; John M. Adams

[57] **ABSTRACT**

A self-contained unit to be attached to a power punch press to provide a feed for stock being fed to the press. The unit contains a direct drive from the punch press crankshaft to feed rolls which are located adjacent to the table of the press. A non-slip, positive, drive is provided from the crankshaft of the punch press to an index drive which receives continuous, uniform rotary motion and converts it into non-continuous, incremental movement of the index drive output shaft. A positive, non-slip drive is provided between the index drive output shaft and the power driven feed roll. The feed roll unit also contains a compressed air-operated cylinder arrangement to release the idler feed roll at a predetermined period during the punch press cycle so that the stock being fed to the press is free from the feed rolls during the pressing portion of the punch press operating cycle. A cam secured to the punch press crankshaft actuates a solenoid valve which, in turn, opens a pilot valve and permits flow of compressed air to reverse the power cylinder, which normally urges the idler feed roll against the power driven feed roll, and thereby releases the idler feed roll to release the stock between the feed rolls of the self-contained unit.

9 Claims, 4 Drawing Figures

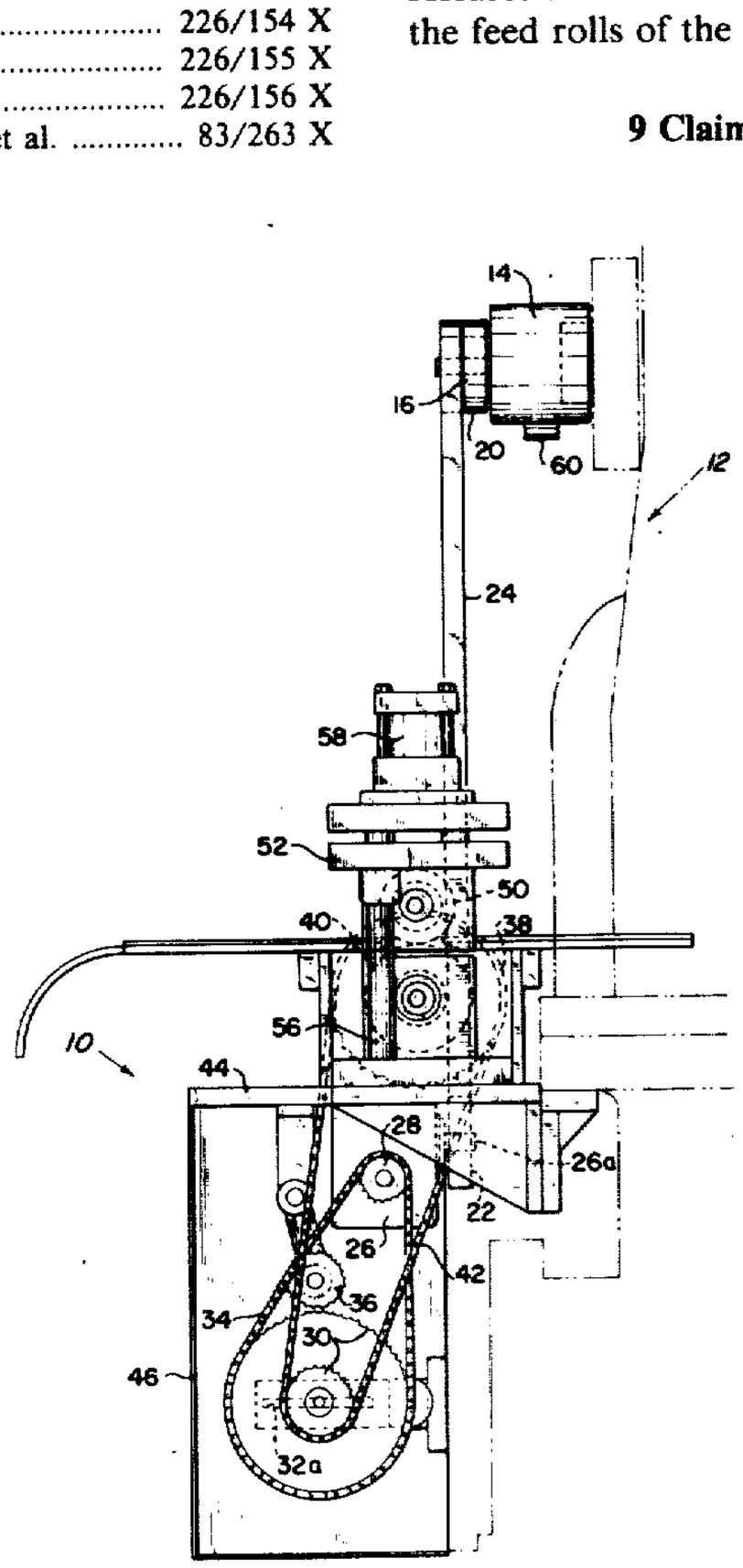
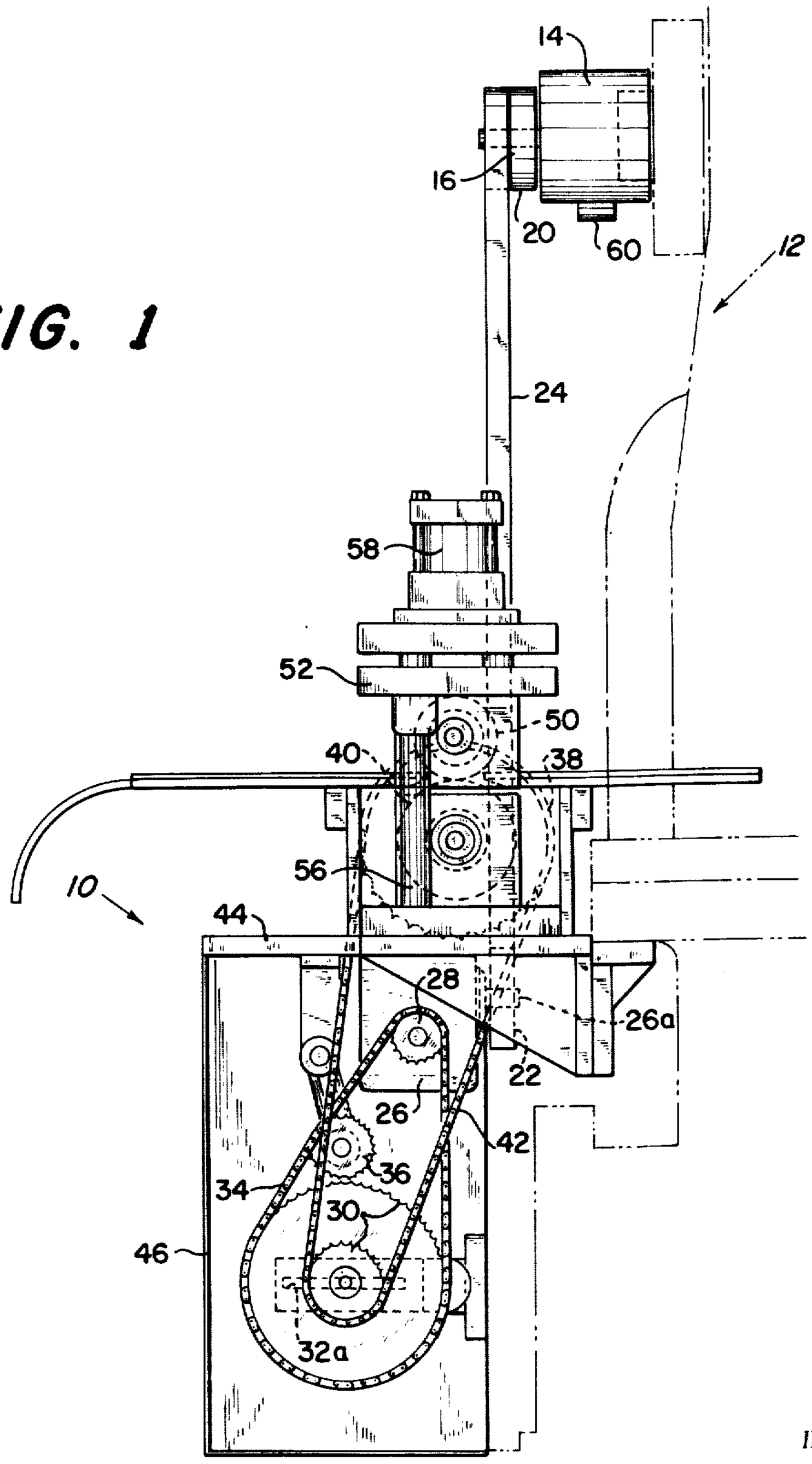


FIG. 1



INVENTOR.
HARRY EYBERGER
BY George Raymond Lee
HIS ATTORNEY

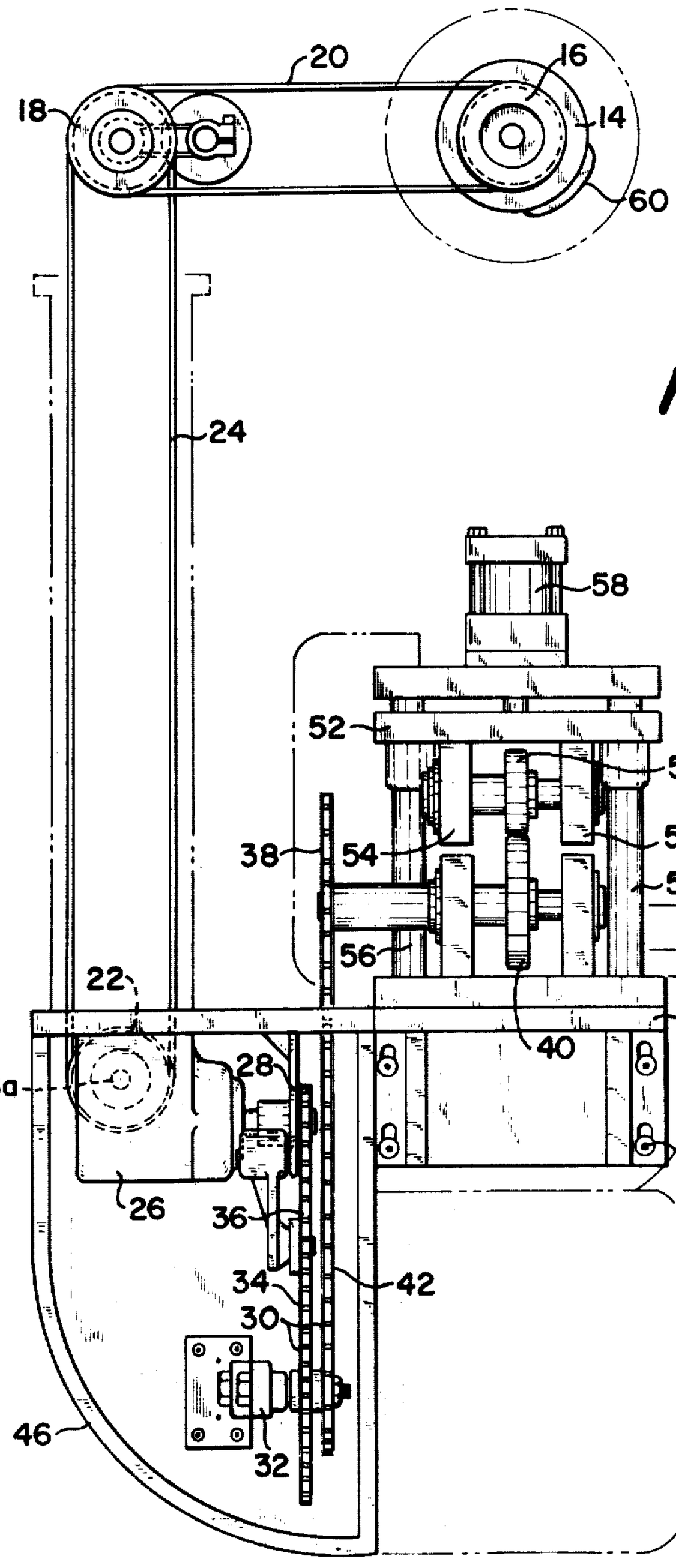


FIG. 2

INVENTOR.
HARRY EYBERGER
BY George Raynovich
HIS ATTORNEY

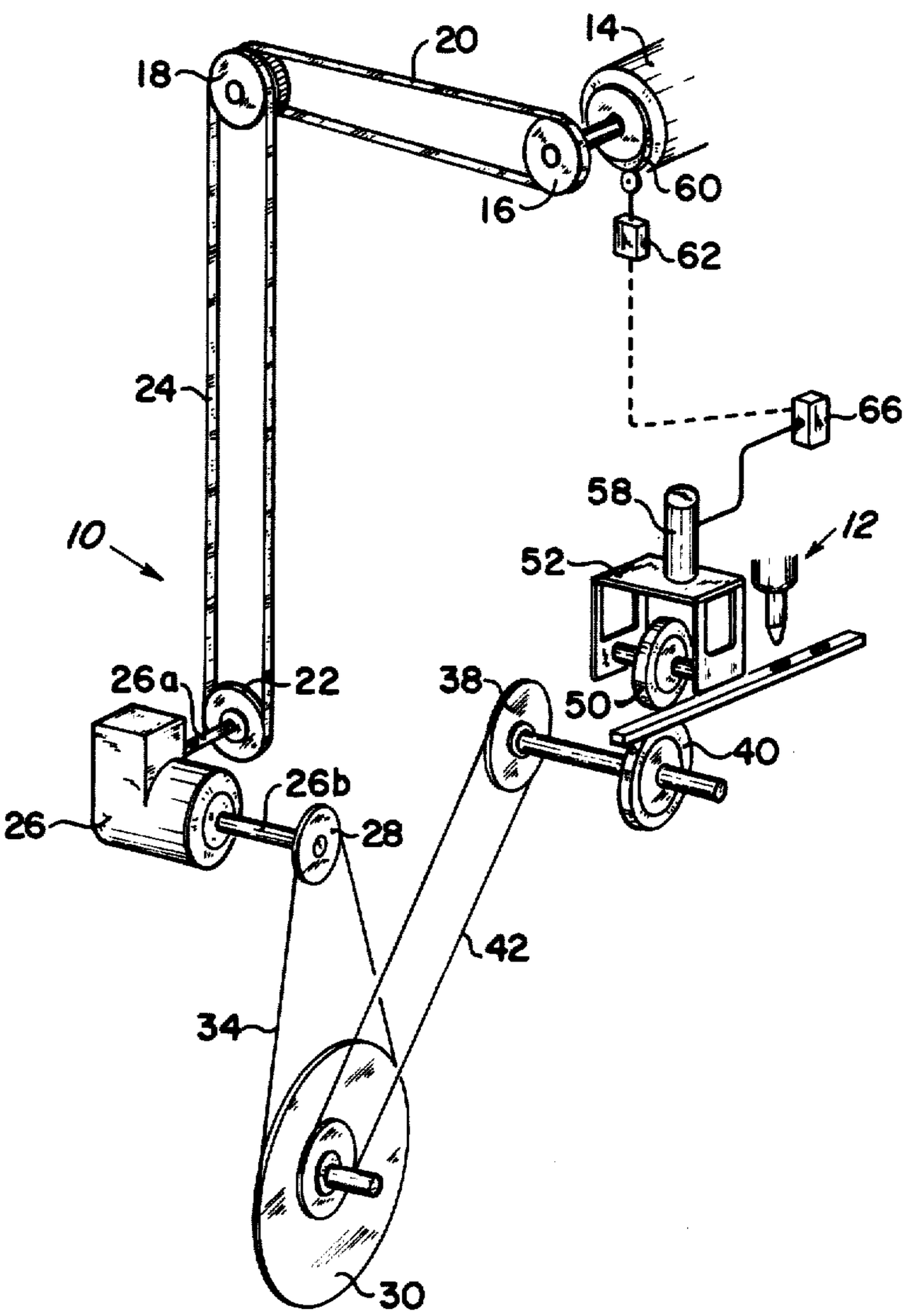


FIG. 3

INVENTOR.
HARRY EYBERGER
BY George Raynovich Jr.
HIS ATTORNEY

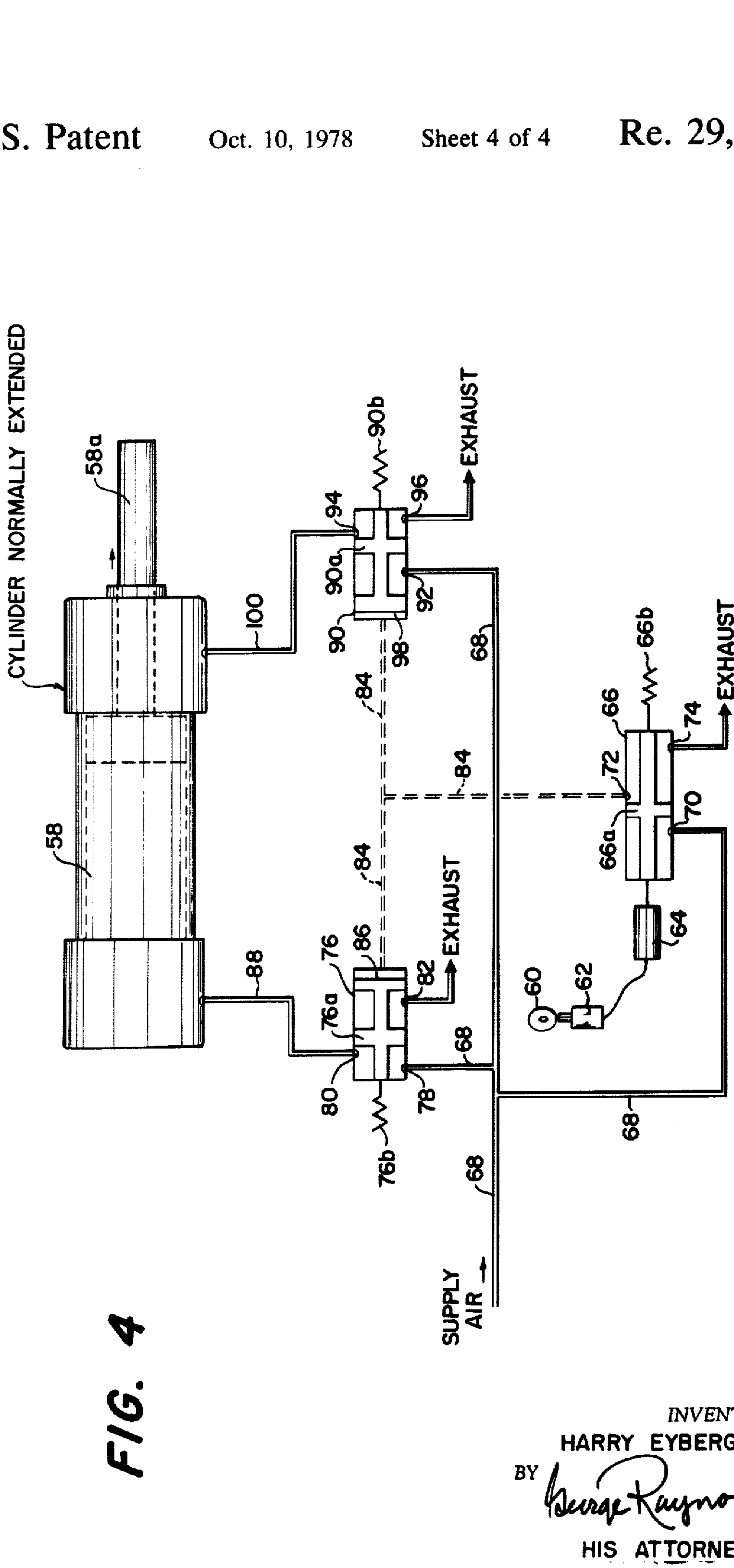


FIG. 4

INVENTOR.
HARRY EYBERGER
BY George Raynovich
HIS ATTORNEY

SELF-CONTAINED FEED ROLL FOR POWER PUNCH PRESSES

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

Power punch press feed rolls are well known and commonly employed to feed punch presses when coils or rolls of continuous strip metal are used for feeding the dies of such presses. Automatic roll feed mechanisms are particularly advantageous in high speed automatic power press operations. In punch press feeds, it is also essential at times that the stock being fed to the punch press be released from the feed as the dies of the press contact the stock. Most dies have piloting arrangements which require that the stock be relatively free to adjust itself as the dies stamp their product.

The release of the stock being fed to the punch press from the feed rolls need be only of short duration to permit the strip locating pins or piloting pins in the die mechanism to engage the work piece and accurately locate the same, relative to the die mechanism. Generally, after the die has performed its function, the feed rolls should again be caused to grip the work strip to feed the next segment to the dies.

In addition, the intricate coordination between the feed roll mechanism and the punch press itself require expert technicians to adjust and set the feed roll mechanism on a punch press. During this adjustment, possible die damage could result if the feed setting is inaccurate.

Many prior feed roll mechanisms for punch presses contained clutches and brakes, which did not permit positive drive between the punch press components and the feed roll mechanism. Without positive drive, the punch press feed roll mechanism would get out of time with the press. As the speed was varied, clutches wore or brakes failed causing spoilage of pieces and damage to tooling.

SUMMARY

The present invention is directed to a novel, self-contained feed roll unit for power punch presses. The unit of the present invention is designed to be attached to punch presses without modification of the punch presses and with a minimum of technical skill required to place the feed roll unit onto the punch press. The feed roll unit of the present invention requires no modification to the punch press other than to provide a direct drive between the punch press crankshaft and the feed roll unit. Further, the feed roll unit of the present invention is a self-contained drive mechanism which has its own housing. The housing of the present invention is bolted onto a punch press and is ready for operation on the press.

The feed roll unit of the present invention provides positive, direct drive between the crankshaft of the punch press and the feed rolls. There is no slippage, clutches, brakes, or other friction-type mechanisms which can cause loss of timing or costly repairs.

Further, the feed roll unit of the present invention provides a novel release means which permits the feed stock to the punch press to be released from the feed rolls during the pressing portion of the operating cycle of the punch press.

With the foregoing considerations in mind, it is an object of the present invention to provide an improved feed roll unit for a punch press.

Another object of the present invention is to provide a self-contained feed roll unit for a punch press.

Another object of the present invention is to provide a feed roll unit having feed roll release means which permit the stock being fed to the punch press to be released during the pressing portion of the operating cycle.

Another object of the present invention is to provide a feed roll unit that enables the punch press to run at higher speeds since the feeding accuracy of this unit is not affected by press speeds.

Another object of the present invention is to provide a feed roll unit which has a direct, non-friction-type drive between the punch press crankshaft and the feed rolls.

These and other objects of the present invention will become apparent as this description proceeds in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevational view of the feed roll unit of the present invention with a portion of the housing removed and showing a portion of the punch press in phantom view.

FIG. **2** is a side elevation similar to FIG. **1** showing the feed roll unit of the present invention with the housing removed.

FIG. **3** is a diagrammatic perspective representation of the working portions of the feed roll mechanism of the present invention in semi-schematic form.

FIG. **4** is a schematic drawing of the components and circuit for the feed roll release means of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and particularly to FIGS. **1**, **2** and **3**, there is shown a self-contained feed roll unit **10** attached to a power press **12** shown in phantom outline. A punch press **12** has a crankshaft **14** which rotates in timed relation to the dies (not shown) of the punch press so that there is a timed relationship to the pressing portion of the punch press operating cycle and the rotational speed of the punch press crankshaft **14**.

A drive pully **16** is fixed to the punch press crankshaft **14** and is of the toothed, non-slip type. An idler pully **18**, containing two pullies which rotate as a unit and which are of the toothed, non-slip type, is rotatably secured to the feed roll unit in spaced relation to the power press crankshaft drive pully **16**. A non-slip type toothed belt drivingly connects the pully **16** to the idler pully **18**.

An index drive input pully **22**, of the non-slip type, is driven from idler pully **18** through non-slip drive belt **24**. The input pully **22** is non-rotatably fixed to the input shaft of index drive **26**. Index drive **26** is preferably but not necessarily a commercially available, right angle index drive manufactured by Commercial Can and Machine Company of Chicago, Ill., or Ferguson Machine Company of St. Louis, Mo. The index drive **26** receives continuous, uniform, rotating motion through input shaft **26a** to which the input pully **22** is fixed. This continuous, uniform, rotating motion is converted by the index drive to a non-continuous, step-by-step, incre-

mental motion that is transmitted by index drive output shaft **26b**.

An output sprocket **28** is non-rotatably secured to index drive output shaft **26b**. A double idler sprocket **30** is freely and rotatably supported on support member **32**. Support member **32** is fixed to the housing of the self-contained feed roll unit **10** and contains an elongated, slotted hole **32a** to receive the shaft of idler sprocket **30**. The slotted hole **32a** permits adjustment of the idler pully in various positions to accommodate various size chains and pullies to thereby adjust the feed stroke of the feed roll unit in a manner to be more fully hereinafter explained.

A drive chain **34** drivingly connects the index drive output sprocket **28** to one portion of the double idler sprocket **30**. A chain tension sprocket **36** is supported from the housing of the feed roll unit **10** to tension chain **34** in the proper manner even though the sizes of idler sprocket **30** may change.

A feed roll drive sprocket **38** is non-rotatably secured to the same shaft to which the power driven feed roll **40** is secured. A drive chain **42** drivingly connects the double idler sprocket **30** to the feed roll drive sprocket **38** to thereby drive the power driven feed roll.

The power driven feed roll **40** is rotatably supported upon a table **44** which forms a portion of the housing **46** for feed roll drive unit **10**. The housing **46** is bolted to the frame of the power press **12** by bolts **48** (FIG. **2**).

An idler feed roll **50** is rotatably supported on a movable frame **52**. The shaft for idler feed roll **50** has trunion mounts **54** that depend from movable frame **52**. Upright members **56** (FIG. **2**) slidingly receive the movable frame **52**.

A power cylinder **58** is fixed to the housing of the feed roll unit **10** and the piston **58a** of power cylinder **58** is connected to movable frame **52** so that the extended piston of power cylinder **58** normally urges the idler feed roll **50** into contact with power driven feed roll **40** to catch the feed stock therebetween and thereby feed the feed stock to the dies of the power press. Under certain conditions, the power of power cylinder **58** can be reversed to release the idler feed roll **50** from the power driven feed roll **40** and thereby release the stock being fed to the dies of the power press.

The power cylinder **58** which controls the idler feed roll **50** is, itself, controlled by a compressed air circuit and valves which operate directly in response to a cam **60** fixed to the crankshaft **14** of power press **12**. The cam **60** is operable to actuate a limit switch **62** (FIGS. **3** and **4**) during a certain portion of the rotational cycle of crankshaft **14**.

When the limit switch **62** is actuated, it provides power to a solenoid switch **64** which actuates a pilot valve **66** (FIG. **4**). Pilot valve **66** is a spool valve which has a spool **66a** mechanically connected to solenoid switch **64**. The spool **66a** is urged by spring **66b** to the position shown in FIG. **4**.

A source of compressed air is directed through air supply line **68** to inlet port **70** of pilot valve **66**. The air supply line **69** also provides an air supply to other valves as shall be hereinafter more fully described.

When the pilot valve **66** is in the non-actuated position shown in FIG. **4**, the spool **66a** prevents passage of air from inlet port **70** to power port **72** in valve **66**. When, however, the solenoid **64** actuates the spool **66a** the spool **66a** is moved to the right as viewed in FIG. **4**, against the force of spring **66b** and the inlet port **70** is permitted to communicate with the power port **72**

thereby causing a flow of air under pressure through the pilot valve **66**.

A spool valve **76** having a spool **76a** urged to the position shown in FIG. **4** by spring **76b** controls the flow of air from its inlet port **78** to a power port **80** in valve **76**. An exhaust port **82** is provided to exhaust flud from valve **76** under certain circumstances. Valve **76** directly receives air under pressure through lines **68** and, in the normal course of events, permits fluid under pressure to flow through inlet port **78** to outlet port **80** and thence through power line **88** to maintain the piston **58a** of power cylinder **58** to the normally extended position.

When the solenoid **64** actuates the pilot valve **66** to permit flow of air under pressure through inlet port **70** to outlet port **72** and thence through pilot line **84**, the air under pressure acts on the cylinder face **86** of spool **76a** of valve **76** to thereby urge the valve spool **76a** to the left as viewed in FIG. **4** and to thereby exhaust a portion of the cylinder **58** which normally maintains piston **58a** to the extended position.

A valve **90** operates to retract piston **58a** of cylinder **58** when solenoid **64** is actuated. The valve **90** has a spool **90a** which is urged to the position shown in FIG. **4** by spring **90b**. The valve **90** has an inlet port **92** through which it receives air under pressure through line **68**. A power port **94** is normally closed from the inlet port **92** by the construction of spool **90a**. The valve **90** also has an exhaust port **96** which is normally in communication with power port **94** so that the portion of the cylinder **58** in front of piston **58a** is normally exhausted.

When air in pilot line **84** acts on the cylinder face **98** of spool **90a**, the valve spool **90a** is urged to the right as viewed in FIG. **4**, against the force of spring **90b**, thereby causing inlet port **92** to come into communication with power port **94** and cause fluid under pressure from line **68** to enter behind the piston **58a** and retract the piston **58a**.

It can be seen that when solenoid **64** actuates pilot valve **66**, air through pilot line **84** simultaneously actuates valves **76** and **90**. Valve **76** is effectively closed and the space in front of piston **58a** is vented to exhaust through exhaust port **82**. At the same time, the space on the other side of piston **58a** is subjected to fluid pressure through line **100** which connects the power port **94** to the cylinder **58**.

OPERATION

As the crankshaft **14** of punch press **12** rotates during the operating cycle of the power press, a direct, non-slip drive is formed through pulley **16**, belt **20**, idler pulley **18**, and belt **24**, to the index drive input pulley **22**. The index drive **26** then converts the continuous, uniform rotary motion into an indexed, non-continuous, incremental, step-by-step motion to its output sprocket **28**. This step-by-step motion is transmitted from output sprocket **28** to idler sprocket **30** which controls the speed of power driven feed roll **40** through power feed roll drive sprocket **38**.

It may be seen that by placing various combinations of sprockets **28**, **30** and **38**, of different sizes, the amount of lineal motion imparted to the feed stock through power driven feed roll **40** may be varied for any single rotation of crankshaft **14**. Thus, the exact length of feed desired may be controlled by changing the size of the sprockets. The indexing increment can also be increased or decreased by the use of various gear trains (not

shown) in place of chains **34** and **42** and sprockets **28**, **30** and **38**.

When the size of idler sprocket **30** is changed, it is positioned along the slotted hole **32a** of the support **32** so that drive chain **42** is in proper tension. The chain tensioner sprocket **36** is then adjusted to properly tension drive chain **34** so that a direct drive is provided between the index drive **26** and the power driven feed roll **40**.

At the same time that the punch press crankshaft **14** rotates, it actuates limit switch **62**, through cam **60**, which in turn causes periodic actuation of solenoid **64**. Each time solenoid **64** is actuated, the piston **58a** of power cylinder **58** retracts from its normally extended position and causes the idler feed roll **50** to be withdrawn and retracted from power driven feed roll **40**. Accordingly, the stock being fed to the power press is released from the feed roll for a period of time, as desired, until the cam passes out from under the limit switch **62**. At that point, power is restored to the power cylinder **58** and the normally extended piston **58a** causes the idler feed roll to bear against the power driven feed roll **40**.

It can be seen that the structure of the present invention provides a self-contained feed roll unit for a power press which may be readily installed on a punch press and can feed stock to the dies of the press. Further, there is positive drive to all components of the feed roll unit of the present invention, and the force on the feed rolls may be released periodically during the pressing operation.

It will also be appreciated that the self-contained feed roll unit of the present invention can be operated without utilizing the feed roll release means of the present invention if the particular job does not require the feed stock to be released during the pressing operation.

According to the provisions of the patent statutes, I have explained the principle, preferred construction, and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A self-contained feed roll unit for a power punch press having a crankshaft rotating in timed relation to the pressing portion of the operating cycle of said punch press, said feed roll unit comprising:

(a) a power driven feed roll;

(b) an idler feed roll rotatably supported on a movable frame and normally urged toward said power driven feed roll, said idler feed roll being periodically moved away from said power driven feed roll by feed roll release means to free stock being fed to said power pass during the pressing portion of said power press operating cycle;

(c) an index drive having an input shaft to receive continuous, uniform rotary motion and an output shaft transmitting non-continuous, incremental rotary motion;

(d) first positive drive means drivingly connecting said index drive input shaft to said power press crankshaft; and

(e) second positive drive means [drivingly connecting] *including a first drive member connected to said index drive output shaft, a driven member connected to said power driven feed roll, an idler member drivingly connected to said first drive member and said driven member to thereby drivingly connect* said index drive output shaft to said power driven feed roll, said second positive drive means being adjustable to vary the ratio of the angular velocity of said index drive output shaft relative to said power driven feed roll.

2. The self-contained feed roll unit of claim **1** wherein said second positive drive means is formed of chains and sprockets connecting said index drive output shaft and said power driven feed roll and the length of stock fed to said power press is varied by changing the sizes of said sprockets.

3. The self-contained feed roll unit of claim **1** wherein said feed roll release means comprises:

(a) a compressed air powered reversible cylinder normally urging said idler feed roll frame toward said power driven feed roll, but actuatable to move said feed roll frame away from said power driven feed roll;

(b) cam means connected to said punch press crankshaft to actuate an electrical solenoid valve while said press is in said pressing portion of said operating cycle;

(c) pilot valve means actuated by said solenoid valve to control flow of compressed air to said reversible cylinder; and

(d) a compressed air circuit between a source of air under pressure and said reversible cylinder and controlled by said pilot valve means to reverse said cylinder when said cam means actuates said solenoid valve.

4. The self-contained feed roll unit of claim 1 wherein the length of the stock fed to said power press is varied by changing the size of at least one of said first drive member, said idler drive member and said driven member.

5. The self-contained feed roll unit of claim 1 wherein the length of stock fed to said power press is varied by changing the size of said idler drive member.

6. The self-contained feed roll unit of claim 1 wherein the length of stock fed to said power press is varied by changing the size of said first drive member.

7. The self-contained feed roll unit of claim 1 wherein the length of stock fed to said power press is varied by changing the size of said driven member.

8. The self-contained feed roll unit of claim 1 which includes,

means to adjust said idler drive member relative to said first drive member and said driven member to permit mounting different sized first drive members, idler drive members and driven members to thereby vary the length of the stock fed to said power press.

9. The self-contained feed roll unit of claim 1 which includes,

means mounting said index drive output shaft in fixed spaced relation to said power driven feed roll.

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