April 14, 1970 C. G. PETERSON 3,505,890

MULTI-PAWL RATCHET INDEXER

Filed Nov. 20, 1968 2 Sheets-Sheet 1

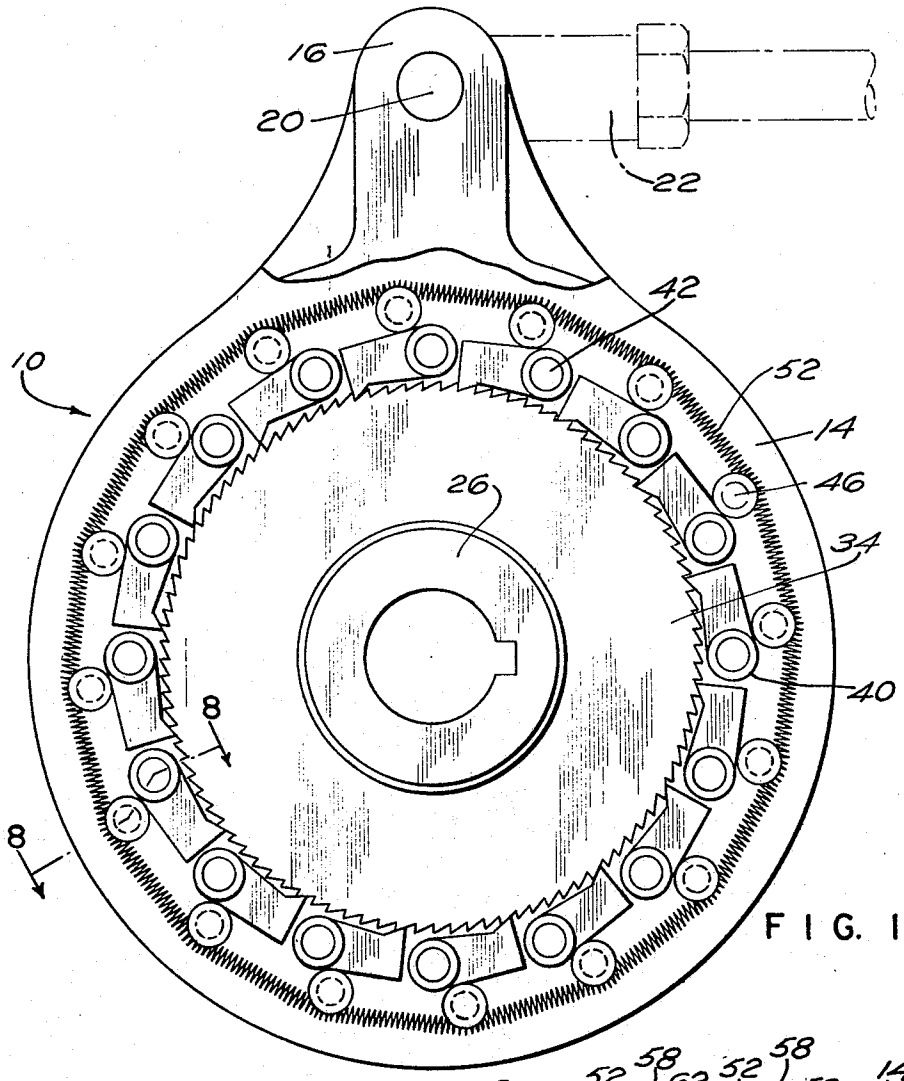

FIG. 1

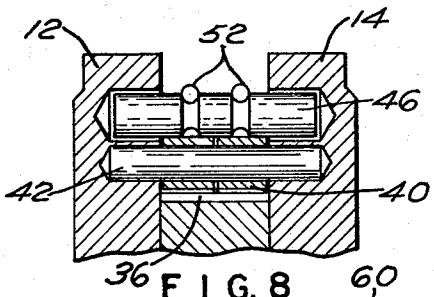

FIG. 8

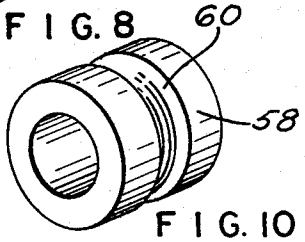

FIG. 10

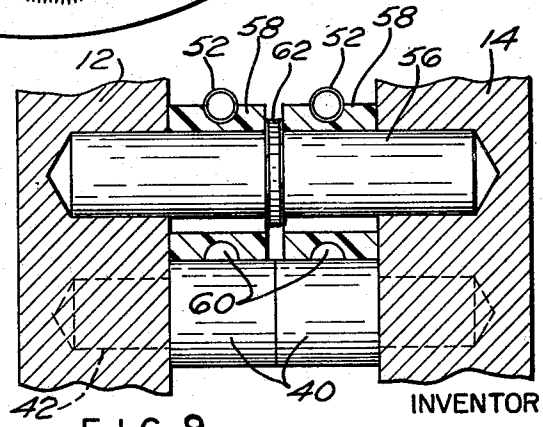

FIG. 9

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April 14, 1970 C. G. PETERSON 3,505,890

MULTI-PAWL RATCHET INDEXER

Filed Nov. 20, 1968 2 Sheets-Sheet 2

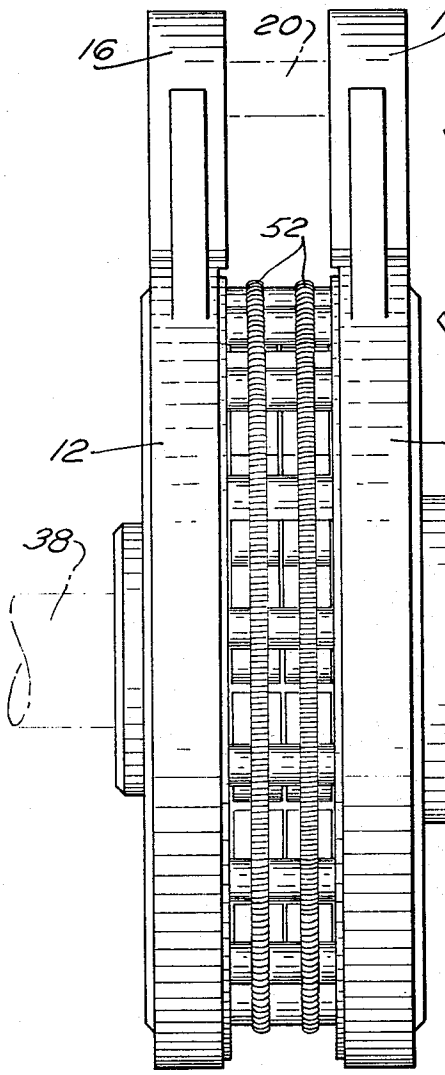

FIG. 2

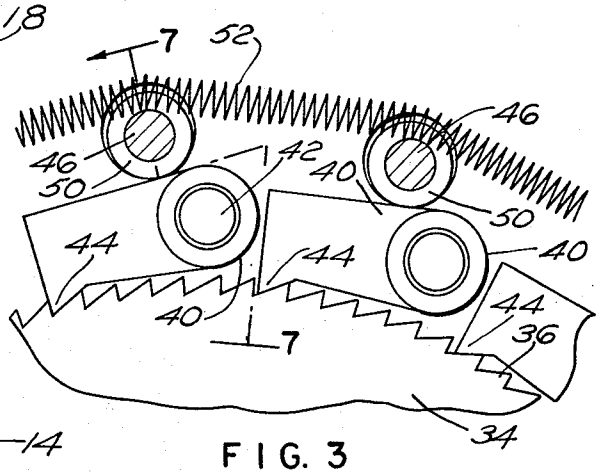

FIG. 3

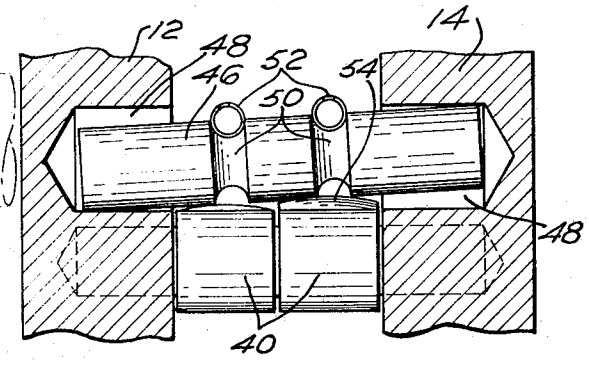

FIG. 7

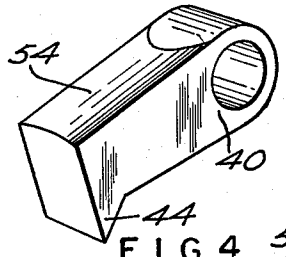

FIG. 4

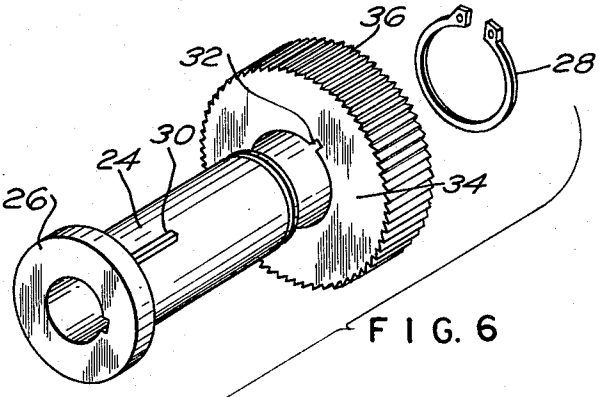

FIG. 6

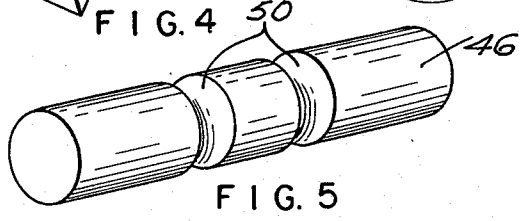

FIG. 5

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3,505,890

MULTI-PAWL RATCHET INDEXER

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Int. Cl. F16h 27/02
U.S. Cl. 74—142 10 Claims

ABSTRACT OF THE DISCLOSURE

A multi-pawl ratchet indexer for close tolerance feeding on any type of roll feed, comprising a ratchet wheel fixed to a shaft, a plurality of pawls extending around the periphery of the ratchet wheel, said pawls being arranged with respect to said ratchet teeth so that there is always at least one pawl in alignment with the driving edge of said teeth, said pawls being pivotally mounted between a pair of spaced plates with means for imparting oscillatory movement to said plates, whereby to intermittently drive said ratchet wheel with a minimum of backlash, and means normally urging said pawls into engagement with said ratchet wheel, said means also functioning to limit the outward movement of the pawls at a point where the pawls barely clear the ratchet wheel.

BACKGROUND OF THE INVENTION

This invention relates to feed mechanisms for stamping presses and the like, as well as other apparatus using a roll feed, and comprises an improvement over U.S. Patent No. 2,591,993, dated Apr. 8, 1952.

In the aforesaid patent, a ratchet wheel is provided for intermittently driving a feed shaft, said ratchet wheel cooperating with a series of pawls extending in a circular path around the peripheray of the ratchet wheel, said pawls having a vernier arrangement with respect to said teeth wherein a minimum of slippage of backlash exists. It has been found desirable, however, particularly in high-speed operations, to provide positive stop means for limiting the outward movement of the pawls, and particularly to limit said outward movement to a point where the pawl just barely clears the teeth of the ratchet wheel. The failure to include such means in the aforesaid patented structure has rendered such structure unsatisfactory for high-speed applications and has further resulted in excessive wear on the spring means that normally urge the pawls toward the ratchet teeth.

SUMMARY OF THE INVENTION

It is therefore a primary object of the instant invention to provide stop means for limiting the outward movement of the pawls in an indexer of the type shown in the aforesaid U.S. Patent No. 2,591,993.

It is a further object of this invention to provide means that simultaneously function as a limit stop for outward movement of the pawls and as a part of the means that normally urge the pawls inwardly toward the ratchet teeth.

Another object is the provision of a multi-pawl ratchet indexer that is capable of operating at much higher speeds than prior art indexers of this type.

Other objects, features and advantages of the invention will become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate the best mode presently contemplated for carrying out the present invention:

FIG. 1 is a side elevational view of an indexer embodying the instant invention with the major portion of the front face plate removed for purposes of illustration;

FIG. 2 is an end elevational view thereof;

FIGURE 3 is an enlarged fragmentary view showing the pawls and ratchet wheel;

FIG. 4 is an enlarged perspective detail of one of the pawls;

FIG. 5 is an enlarged perspective detail of the stop pin;

FIG. 6 is an enlarged exploded perspective view of the hub and ratchet wheel assembly;

FIG. 7 is a sectional view taken on line 7—7 of FIG. 3;

FIG. 8 is a sectional view taken on line 8—8 of FIG. 1;

FIG. 9 is a sectional view illustrating a slightly modified form of my invention; and

FIG. 10 is a perspective detail of one of the collar members embodied in the modified form of my invention.

DESCRIPTION OF THE INVENTION

Referring now to the drawings, there is shown generally at **10** an indexing mechanism for achieving extremely accurate intermittent feed of stock from a feed roll of a stamping press, punch press or the like. It is extremely important in the feed of such stock that the feed be highly accurate and to a close tolerance, thus minimizing stock waste. The mechanism **10** comprises a pair of identical face plates **12, 14** constructed of any suitable structural material, said plates being substantially circular and having aligned extensions **16, 18** receiving a cross rod **20** on which a standard lever arm **22** from the stamping press eccentric (not shown) is pivotally mounted, whereby reciprocal movement of the arm **22**, in response to rotation of the eccentric, results in oscillating movement of the plates **12, 14** as a unit.

The face plates **12, 14** rotatably receive a shaft or hub **24**, said shaft being maintained in assembled relation with the face plates by means of a fixed collar **26** and a retaining ring **28**, note FIG. 6. Keyed to the shaft **24**, as by spline **30** and key **32**, is a ratchet wheel **34** having a plurality of ratchet teeth **36** extending around its outer periphery. As previously stated, the shaft or hub **24** is rotatably mounted with respect to face plates **12, 14**, but is drivingly engaged to the feed roll shaft shown in broken lines at **38** in FIG. 2. Thus, when ratchet wheel **36** is driven by the pawl means hereinafter to be described, shaft or hub **24** turns therewith and simultaneously drives the feed roll shaft **38** to effect the desired feed of stock to the stamping press, punch press or similar equipment.

As will be seen most clearly in FIGS. 1 and 3, a series of pawls **40** is pivotally mounted on cross studs **42**, said cross studs being fixedly received in oppositely disposed bores in face plates **12, 14**, as shown most clearly in FIG. 8. The series of pawls extends circumferentially around the periphery of ratchet wheel **34** and has a vernier arrangement with respect thereto, whereby one pawl in the series will always be in substantial alignment with the driving edge of a ratchet tooth. Thus, backlash is minimized, to the extent that a feed is provided that is accurate to better than $\frac{2}{1000}$ of an inch. Although the invention is operable with one series of pawls extending around ratchet wheel **34**, greater accuracy can be obtained by having more than one side-by-side series of pawls, as illustrated in FIGS. 7 and 8. More specifically, when two side-by-side series of pawls are used, each pair of side-by-side pawls may have their driving edge **44** slightly offset with respect to each other, thus reducing by one-half any backlash that may occur. Expressed differently, by having the two side-by-side series of pawls slightly offset with respect to each other, a vernier arrangement is provided that would be the equivalent of having a single series of pawls but with twice the number of individual pawls. If desired, the two series of pawls may be in complete alignment with each other, as shown in FIG. 8, thus increasing the strength of the drive, although not the accuracy thereof.

The operation and structure of the indexing mechanism **10**, as described to this point, is identical to that of aforesaid U.S. Patent No. 2,591,993. It has been found desirable, however, to provide novel means for limiting outward pivotal movement of the pawls **40**, since by carefully controlling the movement of the pawls, a much greater feed speed can be effectively obtained. The desired stop means is achieved by utilizing cross pins **46**, preferably of nylon, although other suitable materials could be used, there being a pin **46** located above each pawl **40** adjacent to stud **42**, but slightly offset therefrom so that the pin **46** may impart a moment to the pawl or pawls with which it is in engagement. The pins **46** are received in aligned bores **48** located on the inner surfaces of plates **12** and **14**, and it is important to note that the diameter of the bores **48** is substantially larger than the diameter of pins **46**, whereupon the pins are free to move radially with respect to the center of ratchet wheel **34** within predetermined limits. By the same token, the bores **48** are dimensioned so that some degree of lateral or side-by-side play exists between the pins **46** and the plates **12** and **14**. Each pin **46** is provided with a pair of circumferential grooves **50** which are adapted to receive therein a pair of springs **52**, each of which extends in a complete loop around the entire circular series of pins **46**. It will therefore be obvious that the springs **52** bias the pins **46** radially inwardly; and since the pins are in engaement with the pawls **40**, the latter are also normally biased inwardly toward ratchet teeth **36**. The relative diametrical dimensions of bore **48** and pins **46** is such that the pins **46**, under action of the springs **52**, are free to force the pawls radially inward to the complete depth of the ratchet teeth. The outward movement of the pawls is limited to a point where the tooth **34** of the pawl barely clears the outer edge of the ratchet teeth **36**. Actually, the preferred clearance is about $\frac{1}{1000}$ of an inch.

It will be understood that where only one series of pawls **40** is employed, then the pin **46** would necessarily have only one groove **50** and only one spring **52**. Where two series of side-by-side pawls exist, the pins **46** have two grooves **50** and two springs **52**, as illustrated. Where two series of pawls exist and the side-by-side pawls of each series are offset with respect to each other, it has been found desirable to gently curve the upper surface of each pawl **40** as shown at **54** in FIGS. 4 and 7. This curvature facilitates tilting of pin **46** when one pawl is in its down position and the pawl alongside it is in its up position, as illustrated in FIG. 7. Of course, this curvature is not necessary where only one series of pawls is employed, or where side-by-side pawls are in complete phase with each other, as illustrated in FIG. 8.

The fact that the pins **46** may move laterally is important for two reasons. First of all, this lateral play distributes the wear on the pins, and, at the same time, this play is necessary to enable the pin to tilt when one pawl is down and the pawl alongside it is up, as illustrated in FIG. 7. It will also be noted that some degree of rotation of the pins **46** will take place during operation of the device, due to vibration and the like. This rotation causes the springs **52** to move axially, thereby distributing the wear on the springs and hence increasing the working life of the springs.

In FIGS. 9 and 10, a slightly modified form of my invention is shown wherein a pin **56** is fixedly mounted between plates **12** and **14** in lieu of the loosely mounted pin **46**. The desired radial movement is achieved by mounting circular collars **58** on the pin **56**, with the inner diameter of the collars **58** being substantially larger than the outer diameter of pin **56**. Thus, the radial play which exists between collars **58** and pin **56** corresponds to the aforedescribed radial movement of the pins **46** in the bores **48**. The collars **58** are provided with a circumferential groove **60** for receiving the springs **52** in the same manner as the aforedescribed grooves **50**. In order to maintain the collars **58** properly positioned on pin **56**, an enlarged portion **62** is provided at the center of pin **56**, it being understood that said enlarged portion may take the form of a washer secured to the pin or an integral flange provided thereon. Here again, it will be understood that if only one series of pawls is employed, then only one collar **58** would be mounted on pin **56**, and means would be provided for properly positioning the single collar **58** so as to maintain it in alignment with the pawls.

It will now be seen that pursuant to driving movement of the arm **22**, which would be movement to the left when viewing FIG. 1, the ratchet wheel **34** will be drivingly engaged by one of the pawls **40**, said driving engagement taking place with a minimum of slippage and backlash, due to the fact that the vernier arrangement of the pawls with respect to the ratchet wheel insures virtually instant engagement of the ratchet wheel, no matter what the relative position is between the face plates and the ratchet wheel. The pins **46** and their cooperating springs **52** always bias the pawls inwardly, and the pins **46** simultaneously serve as limit stops for controlling the outward movement of the pawls, to a point where the teeth of the pawls barely clear the ratchet teeth, thus enabling the feed to operate much faster than has heretofore been possible. Also, by utilizing the pins **46** simultaneously as the biasing means and the stop means for the pawls, a space saving is effected which enables the indexing mechanism to have maximum compactness.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.

What is claimed is:

1. In a multi-pawl ratchet indexer having a pair of spaced parallel plates, means imparting oscillating movement to said plates as a unit, a shaft extending between said plates and freely rotatable with respect thereto, a wheel keyed to said shaft having a plurality of ratchet teeth extending around its periphery, a series of pawls pivotally mounted between said plates, said pawls being positioned radially outward from the periphery of said ratchet wheel and extending therearound, the improvement comprising means mounted radially outward of each pawl and in engagement therewith, said means being radially movable between a first position wherein rotation of the pawl away from the ratchet teeth is limited to a point where the pawl clears the ratchet teeth but is closely adjacent thereto and a second position wherein the pawl rotates to engage the ratchet teeth for the complete depth of the latter, and resilient means normally biasing said movable means and hence said pawls to said second position.

2. In the indexer of claim **1**, said movable means comprising a pin extending across said plates, recesses in said plates receiving the opposite ends of said pin, said recesses being dismensioned to permit movement of said pins between said first and second positions.

3. In the indexer of claim **2**, said resilient means comprising a spring extending in a complete loop around said pins.

4. In the indexer of claim **3**, each of said pins having a groove extending therearound for receiving said spring.

5. In the indexer of claim **2**, said pins ebing laterally movable between said plates.

6. The indexer of claim **1** further characterized in that two side-by-side series of pawls extend around the periphery of said ratchet wheel, said movable means comprising a pin extending across said plates, recesses in said plates receiving the opposite ends of said pin, said recesses being dimensioned to permit movement of said pins between said first and second position, said resilient means comprising a pair of side-by-side springs, each extending

in a complete loop around said pins with each spring in substantial alignment with one series of pawls, the outer surface of said pawls that is engaged by said pins being gently curved from side to side.

7. In the indexer of claim 1, said movable means comprising a fixed cylindrical pin extending across said plates, and a circular collar mounted on said pin, the inner diameter of said collar being substantially larger than the outer diameter of said pin, whereby said collar is free to move between said first and second positions.

8. In the indexer of claim 7, said resilient means comprising a spring extending in a complete loop around said collars, said collars having means on their outer surface receiving said spring.

9 The indexer of claim 1 further characterized in that two side-by-side series of pawls extend around the periphery of said ratchet wheel, said movable means comprising a fixed cylindrical pin extending across said plates, a pair of circular collars mounted on each pin, the inner diameter of said collars being substantially larger than the outer diameter of said pin, whereby said collars are free to move between said first and second positions, and means for maintaining one series of collars in substantial alignment

with one series of pawls, and the other series of collars in substantial alignment with the other series of pawls.

10. In the indexer of claim 9, said resilient means comprising a pair of side-by-side springs, one extending in a complete loop around one series of collars, and the other extending in a complete loop around the other series of collars, said collars each having an outer circumferential groove receiving its respective spring.

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74—577