United States Patent [19]

Kesten et al.

[11] **3,861,260**

[45] **Jan. 21, 1975**

[54] **DOUBLE BUCKET DIE CUTTING ASSEMBLY**

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[22] Filed: **Nov. 16, 1973**

[21] Appl. No.: **416,663**

[52] **U.S. Cl.** **83/328**, 74/604, 83/543

[51] **Int. Cl.** **B26d 1/56**

[58] **Field of Search** 83/327, 328; 74/604; 100/172, 176

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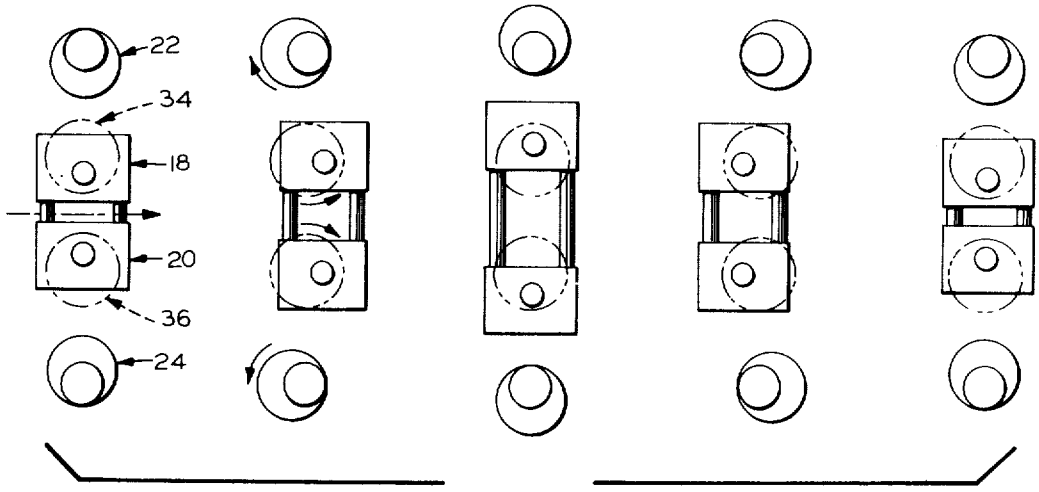
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Assistant Examiner—W. R. Briggs

[57] **ABSTRACT**

A double bucket die cutting assembly is provided which is particularly adaped to be installed at the die cutting station of a press for purposes primarily of accomplishing a punching operation thereat upon a moving web of material passing thereby. The double bucket die cutting assembly includes a frame structure in which a pair of buckets are mounted for eccentric rotation about a drive axis in suitably spaced relation relative to each other whereby to permit the material, upon which it is desired to perform a punching operation, to be passed therebetween. One of the buckets is provided with punch means suitably supported thereon so as to lie in a common plane extending the length of the major axis thereof. The other of the buckets is provided with receiving means operable to permit the punch means to be received therein as the punch means is brought into juxtaposed relation therewith during the rotation of the pair of buckets. The frame structure further includes counterbalancing means comprising a pair of weighted rollers which are supported in the frame structure for rotation relative thereto. Each of the rollers is provided with an irregular distribution of the weight thereof about its axis of rotation so that the heavy portion of the weighted rollers will be disposed to the opposite side of the center line from the buckets thereby providing a counterbalancing force to the weight of the buckets during the rotation of the latter. Alignment means are provided cooperatively associated with each of the pair of buckets so as to ensure that proper alignment between the pair of buckets is maintained during the rotation thereof. The frame structure also serves as a support for a drive means which is operable to drive each of the pair of buckets and each of the pair of weighted rollers so that they rotate in a predetermined fashion whereby to ensure that the pair of weighted rollers accomplish their intended counterbalancing function relative to the pair of buckets.

8 Claims, 6 Drawing Figures



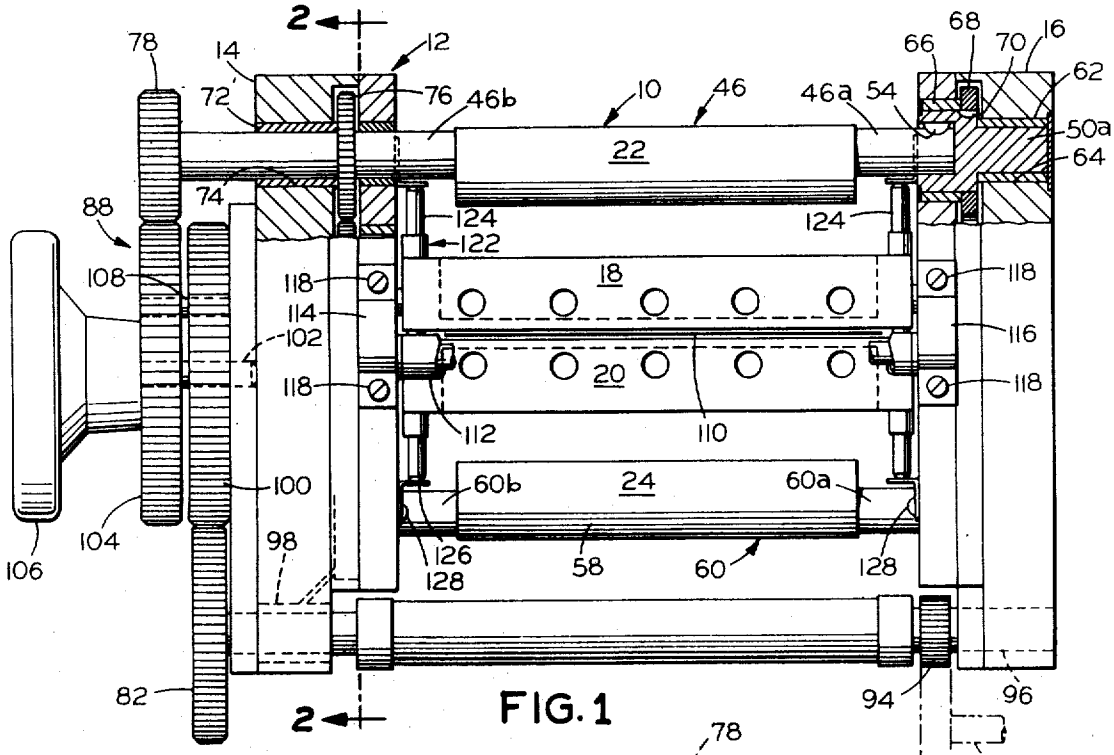


FIG. 1

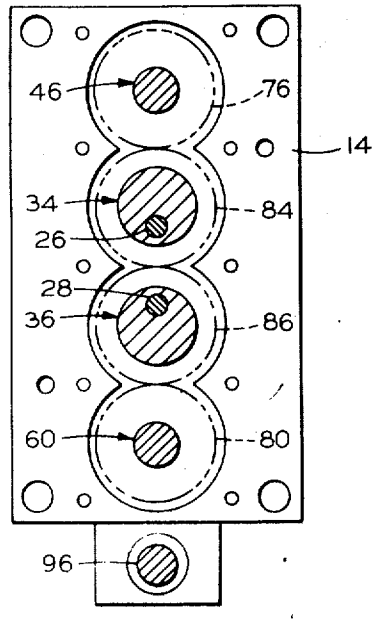


FIG. 2

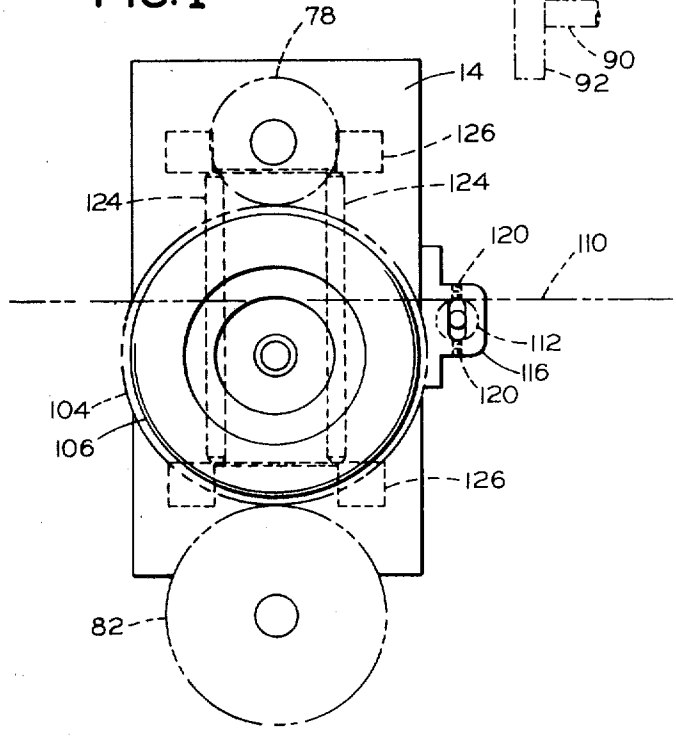


FIG. 3

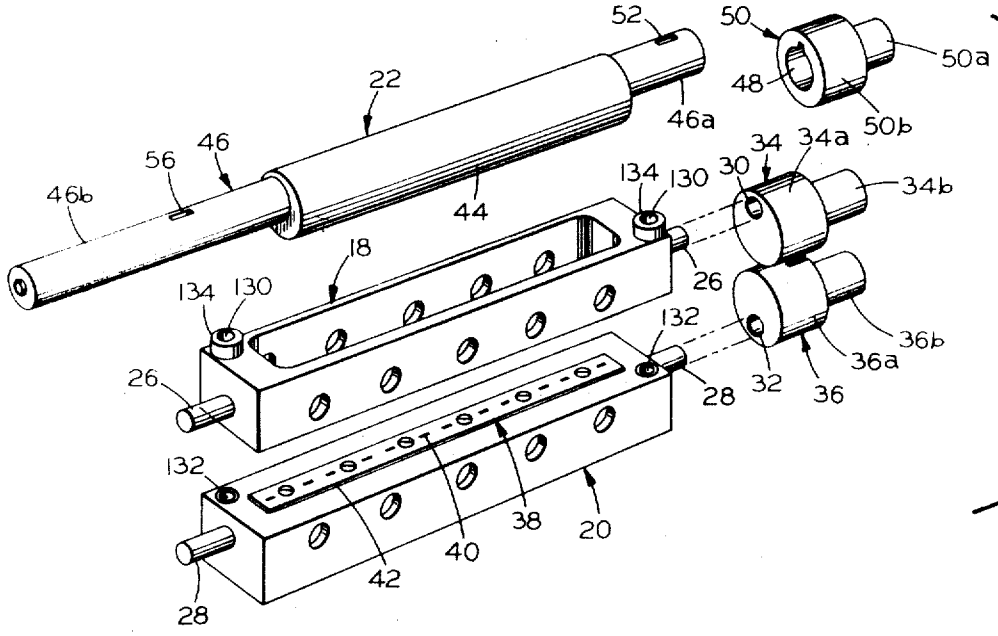


FIG.4

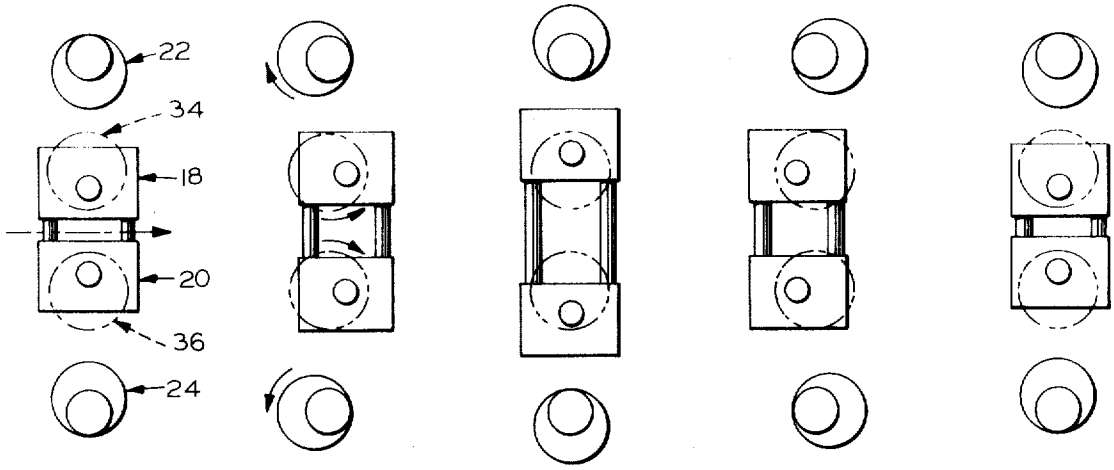


FIG.5

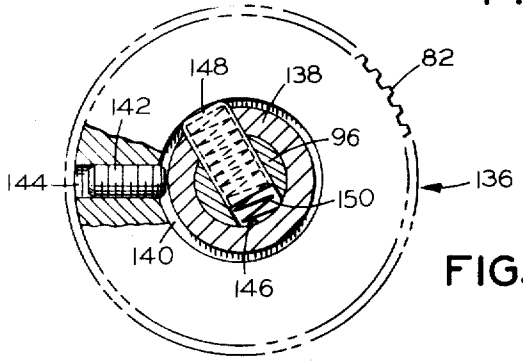


FIG.6

DOUBLE BUCKET DIE CUTTING ASSEMBLY

BACKGROUND OF THE INVENTION

There have long existed in the prior art means adapted to perform punching operations on a variety of different kinds of material. Moreover, it has also long been known heretofore to provide a press with a die cutting assembly capable of performing a punching operation. Based on experiences garnered from the use of such prior art forms of devices, it has been learned that there are a number of features which such devices desirably should possess if they are to operate effectively yet still provide economies during manufacture and during the operation thereof.

One particularly desirable feature which a die cutting assembly should possess is that it be capable of a relatively high rate of speed in order to produce a high rate of production, i.e., perform a large number of operations per a given unit of time. In this connection, it has been recognized that one of the areas in which prior art devices have shown a limitation is in their speed of operation. More specifically, means have long been available heretofore which are capable of feeding stock to a die cutting assembly at a relatively high rate of speed. Although improvements have been made through the years in the design for die cutting assemblies in an effort to increase the speed of operation thereof such as, for example, by providing a die cutting assembly which is capable of performing a punching operation on a moving web of stock material, the speed at which even these latter forms of prior art devices are capable of operating still remains less than the speed at which the stock material is capable of being fed thereto. Accordingly, there has existed a potential for achieving higher production rates by virtue of providing a die cutting assembly which is capable of operating at a speed corresponding to the optimum rate at which the stock material is capable of being fed thereto.

Another feature which a die cutting assembly desirably should possess is that of being capable of performing a series of operations in relatively closely spaced relation to each other on a web of material. Heretofore, the relatively large size of the operating components of the die cutting assembly have commonly limited the capability of the latter assembly to permit repeat operations on shortened lengths of material travel. In this connection, it has been known to provide a plurality of closely spaced die cutting means in one assembly in an effort to provide the aforedescribed capability. However, to do so increases the complexity of the assembly and concomitantly most often the cost of manufacture, and the assembly thereof.

Accordingly, it is an object of the present invention to provide a novel and improved double bucket die cutting assembly which embodies a construction that enables an increase to be achieved in the speed with which operations are capable of being performed thereby.

It is also an object of the present invention to provide such a double bucket die cutting assembly which permits repeat operations to be performed in shortened lengths of stock travel.

It is a further object of the present invention to provide such a double bucket die cutting assembly which is characterized by the fact that it is easily installable in conventional fashion in a press and occupies only limited space when mounted therein.

Still another object of the present invention is to provide such a double bucket die cutting assembly which is capable of performing operations on a continuously moving web of stock thereby enabling stock to be fed through the assembly at a relatively high rate of speed.

A still further object of the present invention is to provide such a double bucket die cutting assembly which permits the buckets thereof to be easily changed for purposes of altering the pattern produced thereby as a result of the operation thereof.

Yet another object of the present invention is to provide such a double bucket die cutting assembly which produces during the operation thereof a definite penetration in the stock thereby to effectively separate the waste from the latter stock.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects can be readily attained in a double bucket die cutting assembly which is operable when installed at the die station of a press for performing punching operations on a continuously moving web of stock being fed thereby.

The double bucket die cutting assembly includes a frame structure in which a pair of buckets are rotatably mounted in suitably spaced relation relative to each other whereby to permit stock upon which it is desired to perform a punching operation, to be passed therebetween. One of the buckets is provided with punch means suitably supported thereon so as to lie in a common plane extending the length of the major axis thereof. The other of the buckets is provided with receiving means operable to permit the punch means to be received therein as the punch means is brought into juxtaposed relation therewith during the rotation of the pair of buckets. The frame structure further includes a counterbalancing means which is supported thereon for rotation relative thereto. The counterbalancing means is disposed to the opposite side of the center line from the buckets thereby providing a force which is effective to counterbalance the weight of the buckets during the rotation of the latter. Alignment means are provided cooperatively associated with each of the pair of buckets so as to ensure that proper alignment between the pair of buckets is maintained during the rotation thereof. The frame structure also functions as a support for a drive means which operates to drive the pair of buckets and the counterbalancing means in unison so as to ensure that the counterbalancing means performs the proper counterbalancing function as the buckets rotate.

In accordance with the preferred embodiment of the invention, the double bucket die cutting assembly includes a frame structure comprised of a pair of elongated, suitably spaced frame members. Supported for rotation in the frame structure are a plurality of stub shafts. The pair of buckets are each mounted eccentrically on a corresponding pair of these stub shafts such that the buckets are positioned between the frame members and extend transversely substantially at right angles thereto. Alignment means preferably in the form of a plurality of pins are cooperatively associated with the pair of buckets. The pins function to interconnect the pair of buckets whereby to ensure that a proper continual alignment exists therebetween as the pair of

buckets are caused to rotate. A pair of weighted rollers are mounted for rotation on the frame members, and are positioned so as to extend between the frame members on either side of the buckets. Each of the weighted rollers has the weight thereof unequally distributed about its axis of rotation so that the heavy portion of the weighted rollers is disposed to the opposite side of the center line from the buckets thereby providing a counterbalancing force to the weight of the buckets during rotation of the latter. Drive means operable to drive the pair of buckets and the pair of weighted rollers in unison are supported on the frame structure. The drive means preferably includes a plurality of interconnected gears which are respectively mounted on the pair of buckets and the pair of weighted rollers.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view partially in section and with some parts broken away for purposes of clarity of illustration of a double bucket die cutting assembly constructed in accordance with the present invention;

FIG. **2** is a cross sectional view of the double bucket die cutting assembly of the present invention taken substantially along the line **2—2** in FIG. **1**;

FIG. **3** is an end view of the left end of the double bucket die cutting assembly of FIG. **1** constructed in accordance with the present invention;

FIG. **4** is an exploded perspective view of the pair of buckets and one of the pair of weighted rollers embodied in a double bucket die cutting assembly constructed in accordance with the present invention;

FIG. **5** is a schematic representation of the movements during one revolution of the pair of buckets and the pair of weighted rollers of a double bucket die cutting assembly constructed in accordance with the present invention; and

FIG. **6** is a side elevational view partially in section of an override clutch for a double bucket die cutting assembly constructed in accordance with the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring now to the drawings and more particularly FIG. **1** thereof, there is illustrated therein a double bucket die cutting assembly, generally designated by reference numeral **10**, constructed in accordance with the present invention. The double bucket die cutting assembly **10** includes a frame structure **12** which is comprised of a pair of elongated substantially T-shaped frame members **14** and **16**. The members **14** and **16** function as a support means for the various elements which comprise the double bucket die cutting assembly **10** including the punch bucket **18** and the die bucket **20**, and the pair of weighted rollers **22** and **24**.

As best understood with reference to FIG. **4** of the drawings, each of the buckets **18** and **20** is generally rectangular in configuration and has a substantially hollow interior. Projecting outwardly from each end of each of the buckets **18** and **20** is a pin-like shaped member **26** and **28**, respectively. The latter members **26** and **28** are suitably dimensioned so as to be receivable in an opening **30** and **32**, respectively, provided for this purpose in one end of corresponding pairs of stub shafts **34** and **36**, respectively. In the interest of clarity of illustration, only one of each of the corresponding pairs of shafts **34** and **36** has been depicted in FIG. **4** of the drawings. Each of the shafts **34** and **36** is formed with an enlarged portion **34***a* and **36***a*, respectively, which contains the openings **30** and **32** in which the pin-like members **26** and **28**, respectively, are received. In addition, each of the shafts **34** and **36** is provided with a smaller shaft-like portion **34***b* and **36***b*, respectively, the latter providing the means whereby the buckets **18** and **20** are rotatably mounted on the frame members **14** and **16** as will be described more fully hereinafter. Referring further to FIG. **4** of the drawings, it can be seen therefrom that the openings **30** and **32** are located off center relative to the axis of rotation of the shafts **34** and **36**. Accordingly, the buckets **18** and **20** when mounted to the shafts **34** and **36** are mounted eccentrically relative thereto whereby to provide a particular mode of operation for the assembly **10** to which further reference will be had subsequently. Although not shown in the drawings, it is to be understood that the punch bucket **18** is provided with a plurality of punches (not shown) which are suitably supported thereon so as to extend substantially the entire length of the major axis thereof. Similarly, the die bucket **20** is provided with cooperable die means **38** which are operable to coact with the punches of punch bucket **18** so as to perform the desired punching operation on a web of stock as the latter passes therebetween. The die means **38** may take any suitable form such as, for example, the form depicted in FIG. **4** of the drawings, i.e., a plurality of openings **40** which are formed in a plate **42** so as to be spaced relative to each other therealong, and with the plate **42** extending substantially the entire length of the major axis of the die bucket **20**. The plate **42** may be affixed to the die bucket **20** through the use of any suitable conventional fastening means.

Turning now to a description of the pair of weighted rollers **22** and **24**, the latter as will be referred to more fully hereinafter during the course of the description of the mode of operation of the double bucket die cutting assembly **10**, function as a counterbalancing force for the weight of the buckets **18** and **20** as the latter are caused to rotate. With reference to the weighted rollers **22** and **24**, inasmuch as the construction of each of the rollers **22** and **24** is generally the same, the description thereof will be limited hereinafter to a description of the weighted roller **22** as shown in FIG. **4** of the drawings. The weighted roller **22** consists of a heavy portion **44** of cylindrical configuration which is eccentrically supported on a shaft **46** so as to be positioned at equal distances from the frame members **14** and **16**. The eccentric mounting of the cylindrical portion thus provides an unequal distribution of the weight about the axis of rotation thereof. As such, end **46***a* of the shaft **46** extends outwardly from the heavy portion **44** to a lesser distance than does the other end **46***b* of the shaft **46**. The short end **46***a* of the shaft **46** is suitably dimensioned so as to be receivable in an opening **48** provided therefor in a plug bushing **50**. Preferably, as shown in FIG. **4** of the drawings, the short end **46***a* of the shaft **46** is provided with a slot **52** with is adapted to cooperate with a key **54**. The key **54** which is illustrated in FIG. **1** of the drawings is received in the slot **52** when the short end **46***a* of shaft **46** is inserted into the opening **48** and functions to securely interconnect the shaft **46** and thereby the weighted roller **22** at one end to the plug bushing **50**. The other end **46***b* of the shaft **46** also has a slot **56** formed therein for a purpose yet to be de-

scribed. As can be seen from FIG. 1 of the drawings, the weighted roller 24 which is substantially identical in construction to the weighted roller 22 also consists of a heavy portion 58 which is provided on a shaft 60 so as to be equally spaced from the frame members 14 and 16 thereof in the manner referred to hereinabove in connection with the description of the construction of weighted roller 22.

Referring now again to FIG. 1 of the drawings, with the end 46*a* of shaft 46 inserted in opening 48 of the plug bushing 50, for purposes of supporting the weighted roller 22 on the frame structure 16 the smaller diameter portion 50*a* of the plug bushing 50 is inserted into a bearing 62 which is in turn positioned in an opening 64 provided for this purpose in the frame member 16. The larger diameter portion 50*b* of the plug bushing 50 is received in similar fashion in a bearing 66. The bearing 66 has a lesser length than does the portion 50*b* of plug bushing 50 whereby to enable a gear 68 to be positioned between the end of bearing 66 and the shoulder provided between the portions 50*a* and 50*b* of the bushing 50. The opening provided in the bearings 62 and 66 to receive plug bushing 50 is suitably dimensioned to enable the gear 68 to be received therein so as to be capable of rotation relative thereto. For purposes of maintaining the gear 68 properly aligned on the portion 50*b* of plug bushing 50, the gear 68 is preferably provided with a key 70 which is adapted to be received in a slot (not shown) formed for this purpose in the portion 50*b*.

With further reference to FIG. 1 of the drawings, it can be seen therefrom that the longer end 46*b* of weighted roller 22 is of sufficient length to pass through and extend outwardly of a bearing 72 which is positioned in an opening 74 provided for this purpose in the frame member 14. A gear 76 is preferably affixed to the end 46*b* by means of a key (not shown) which is received in the slot 56 to which reference was had previously hereinabove. The opening 74 provided in the frame member 14 is suitably dimensioned so as to permit the gear 76 to be received therein and to be rotatable relative thereto. A second gear 78 to which further reference will be had hereinafter is suitably mounted such as by being keyed thereto at the tip of the longer end 46*b* so as to rotate with the shaft 46.

Although not specifically depicted in the drawings, it is to be understood that the weighted roller 24 is supported on the frame members 14 and 16 so as to extend therebetween substantially at right angles thereto in the same manner as has been set forth hereinabove in connection with the description of the manner in which the weighted roller 22 is mounted. Namely, both short ends 60*a* and 60*b* of the shaft 60 of the weighted roller 24 are inserted into plug bushings (not shown) similar in construction to the plug bushing 50. With the shaft end 60*a* so mounted in the plug bushing, the latter in turn is inserted in an opening (not shown) provided for this purpose in the frame member 16. The end 60*a* of shaft 60 also has a gear (not shown), which is similar in construction to the gear 68, supported thereon so as to be rotatable therewith. The other end 60*b* of the shaft 60 mounts into a bearing (not shown) which is provided in an opening (not shown) provided therefor in the frame member 14. Also, there is mounted a gear 80 which is similar in construction to the previously described gear 68 which is mounted on the shaft end 46*a*.

With regard to the manner in which the buckets 18 and 20 are supported on the frame members 14 and 16, this is accomplished in a manner similar to the way the short shaft ends 46*a* and 60*a* of weighted rollers 22 and 24, respectively, are mounted on the frame member 16. More particularly, as was described previously hereinabove, the pin-like members 26 of punch bucket 18 are mounted in a corresponding pair of stub shafts 34, only one of which is illustrated in FIG. 4, and the pin-like members 28 of die bucket 20 are mounted in a corresponding pair of stub shafts 36, only one of which is shown in FIG. 4. Each of the pair of stub shafts 34 is positioned in an opening (not shown) provided therefor in a corresponding one of the frame members 14 and 16. In similar fashion, the pair of stub shafts 36 are each positioned in an opening (not shown) also provided therefore in a corresponding one of the frame members 14 and 16. Thus, with the stub shafts 34 and 36 supported in the aforedescribed manner in the frame members 14 and 16, and with the pin-like members 26 and 28 inserted in the openings 30 and 32, respectively, provided for this purpose in the stub shafts 34 and 36, the buckets 18 and 20 are positioned so as to extend between and substantially at right angles to the frame members 14 and 16, as depicted in FIG. 1 of the drawings. The openings (not shown) formed in the frame members 14 and 16 in which the stub shafts 34 and 36 are inserted are suitably located along the length of each of the frame members 14 and 16 so that the buckets 18 and 20 are capable, as will be referred to more fully hereinafter to move in a vertical plane as viewed with reference to FIG. 1 relative to the weighted rollers 22 and 24, respectively, as the buckets 18 and 20 rotate through one complete revolution. In accord with the preferred embodiment of the invention, the stub shafts 34 and 36 which are supported in the frame member 16 are each provided with a gear (not shown) which is similar in construction to the gear 68 which is affixed to the plug bushing 50. These gears are suitably affixed, such as by being keyed thereto, to the larger diameter portions 34*a* and 36*a* of the stub shafts 34 and 36, respectively. Similarly, each of the stub shafts 34 and 36 which are supported in the frame member 14 have mounted thereon a gear 84 and 86, respectively, which is similar in construction to the gear 68 which is affixed to the shaft end 46*a* of weighted roller 22. Accordingly, the openings (not shown) which are provided in the frame members 14 and 16 and in which the stub shafts 34 and 36 are supported are also suitably located therein so that the gears (not shown) which are affixed to the stub shafts 34 and 36 which are supported in frame member 16 are capable of meshing with the gear 68 supported on the plug bushing 50 and with the gear (not shown) which is supported on the plug bushing (not shown) in which the shaft end 60*a* of weighted roller 24 is supported and so that the gears 84 and 86 which are affixed to each of the other stub shafts 34 and 36 which are supported on the frame member 14 are capable of meshing with the gear 76 and with the gear 80 which is affixed to the shaft end 60*b* of weighted roller 24.

Referring again to FIG. 1 of the drawings, the power by which the rotation of the buckets 18 and 20 and the weighted rollers 22 and 24 is accomplished, is derived from the drive of the press, etc., (not shown) in which the double bucket die cutting assembly 10 of the present invention is embodied. To this end, the double

bucket die cutting assembly **10** is provided with a drive means **88** which is supported on the frame structure **12** and is capable of being operatively connected to the drive of the press, etc. As shown in FIG. **1**, drive in accord with the illustrated embodiment of the invention is imparted from the press, etc. through shaft **90** and a gear **92** supported thereon so as to be rotatable therewith to a gear **94** which is affixed to the shaft **96** so as to rotate therewith. One end of the shaft **96** is supported for rotation in a suitable bearing provided therefor in the frame member **16** while the other end of shaft **96** passes through and extends outwardly of a bearing **98** which is suitably positioned in an opening provided for this purpose in the frame member **14.** The latter end of the shaft **96** has a gear **82** supported thereon for rotation therewith. The gear **82** in turn meshes with a gear **100** which is carried on a shaft **102** which is supported on the frame member **14** so as to be rotatable relative thereto. There is also supported on the shaft **102,** a second gear **104** and a wheel **106,** the latter being provided for a purpose which will be referred to subsequently. In accord with the illustrated embodiment, gears **100** and **104** are further interconnected by pin means **108** suitably received in openings (not shown) provided therefor in the gears **100** and **104.**

Turning now to a description of the mode of operation of the double bucket die cutting assembly **10,** the shaft **96** is caused to rotate by virtue of the drive which is imparted thereto from the press, etc., through the shaft **90** and gears **92** and **94.** As the shaft **96** rotates, the gear **82** carried thereby also rotates thereby causing gear **100** to also rotate. The rotation which is imparted to the gear **100** is also transmitted primarily through shaft **102** to the gear **104** and therefrom to the gear **78.** Since gear **78** is affixed to the shaft **46** for rotation therewith, as the gear **78** rotates the shaft **46** is also caused to rotate. When the shaft **46** rotates, the rotation thereof is transmitted through gear **76** to the gears **84, 86** and **80** by virtue of the interconnection which exists therebetween as depicted in FIG. **2** of the drawings. In similar fashion, rotation of shaft **46** also causes gear **68** to rotate and the latter in turn transmits its rotation to the gears (not shown) which are supported in frame member **16** on the ends of the stub shafts **34** and **36** and the plug bushing (not shown) in which the shaft end **60*a*** of the weighted roller **24** is mounted. Thus, it can be seen that the drive from the press, etc., is effective to cause the buckets **18** and **20** and the weighted rollers **22** and **24** to rotate in unison as a result of the rotation of the plurality of gears which the buckets **18** and **20** and the weighted rollers **22** and **24** are interconnected.

As the buckets **18** and **20** rotate between a closed position, defining a work station i.e., the position thereof which is illustrated in FIG. **1** of the drawings, and an open position wherein the buckets **18** and **20** are spaced relatively far apart, a continuous web **110** of stock material is continually being fed therebetween by suitable press means (not shown). When the buckets **18** and **20** occupy their closed position, the punches (not shown) supported on the punch bucket **18** penetrate the web **110** thereby providing the latter with one or more perforations. Thus, a work operation which may, as described hereinabove by way of illustration, take the form of a punching operation, is performed on the web **110** during each complete revolution of the buckets **18** and **20.**

In connection with the feeding of the web **110** to the assembly **10,** it has been found desirable to mount a pair of rollers **112** adjacent to the entrance and exit end of the assembly **10** suitably positioned so that the web **110** travels over the rollers **112.** A pair of brackets **114** and **116** which are fastened to the frame members **14** and **16,** respectively, by means of conventional fasteners **118** are employed for purposes of supporting each roller **112** on the assembly **10.** More specifically, the opposite ends of the roller **112** are inserted into the brackets **114** and **116,** and are held therein by any suitable means such as by means of a plurality of set screws **120.**

Obviously, it is important in order to accomplish the desired work operation that the punch bucket **18** and the die bucket **20** remain continually in proper alignment relative to each other as they are caused to rotate. Therefore, in accord with the preferred embodiment of the invention, the double bucket die cutting assembly **10** is provided with an alignment means **122.** The alignment means consists of a pair of pins **124** and a plurality of brackets **126.** The latter brackets **126** as best seen in FIG. **1** of the drawings are secured to the frame members **14** and **16** by suitable fasteners **128** so as to be located between the weighted rollers **22** and **24,** and slightly spaced from the shafts **46** and **60** thereof. The pins **124** are positioned in openings **130** and **132** provided for this purpose in diagonally opposite corners of the buckets **18** and **20,** respectively. As depicted in FIG. **4** of the drawings in connection with the illustration thereof of the bucket **18,** openings **130** and **132** are preferably provided in bearings **134** with each of the openings **130** and **132** in buckets **18** and **20** in alignment with each other. Each of the pins **124** is suitably dimensioned so that the length thereof is such that when the pins **124** are positioned in the openings **130** and **132** in the buckets **18** and **20** and the latter buckets **18** and **20** are supported between the frame members **14** and **16** as shown in FIG. **1** of the drawings, the tips of the pins **124** are in engagement with a corresponding pair of the plurality of brackets **126,** and allowed to move in a horizontal direction from the rotation of stub shafts **34** and **36.** The pins **124** function to interconnect the buckets **18** and **20** so as to ensure the continual proper alignment thereof as the buckets **18** and **20** are caused to rotate while yet permitting vertical movement of the buckets **18** and **20** along the pins **124.**

If so desired, the double bucket die cutting assembly **10** may be provided with an override clutch means **136** which is operable to permit slippage to occur between the drive being imparted from the press to the drive means **88** of the assembly **10** in the event that a malfunction should occur in the operation of the assembly **10** thereby to prevent damage being done to any of the components of the latter. In accord with the preferred employment thereof, the clutch means **136** is mounted on the end of shaft **96** and is operable to cause slippage between the shaft **96** and the gear **82.** As best understood with reference to FIG. **6** of the drawings, the clutch means **136** includes a bushing **138** which is interposed between the shaft **96** and the gear **82.** The latter bushing **138** is provided with a cutout portion **140** to which further reference will be had hereinafter. In addition, the gear **82** has a radially extending opening **144** formed therein which is threaded so as to be capable of receiving the set screw **142** therein, the latter set screw **142** being threaded in the opening **144** into engage-

ment with the cutout surface **140** of the bushing **138**. As further shown in FIG. **6**, an opening **146** is provided through the bushing **138**, and the shaft **96**. Inserted in the opening **146** is a spring **148** which is employed to bias a cap **150** outwardly into engagement with the inner surface of the gear **82**. The method of operation of clutch means **136** is such that during normal operation of the assembly **10**, when the shaft **96** is rotated, the spring biased cap **150** is rotated into engagement with the set screw **142** and bears thereagainst causing the rotation of the shaft **96** to be transmitted therethrough to the gear **82**. However, in the event that a blockage or some other form of malfunction should occur causing the gear **82** to seek to resist the imparting thereto of a rotational movement, as the shaft **96** continues to rotate the spring biased cap **150** is biased inwardly against the bias of the spring **148** into the opening **146** by the set screw **142** thereby permitting the shaft **96** to rotate past the set screw **142** and thereby providing slippage between the shaft **96** and the gear **82**.

Referring now to FIG. **5** of the drawings, the manner in which the weighted rollers **22** and **24** function to provide a counterbalancing force to the weight of the buckets **18** and **20** during the rotation thereof is most clearly understood with reference to the illustrations in FIG. **5** of the sequential movements which the buckets **18** and **20** and the weighted rollers **22** and **24** undergo during one complete revolution. Beginning at the left side of FIG. **5**, the positions in which the buckets **18** and **20** and the weighted rollers **22** and **24** are shown correspond to the closed position of the buckets **18** and **20** wherein work is being performed thereby on the web **110**, i.e., the positions thereof shown in FIG. **1** of the drawings. It can thus be seen that in this first position the heavy portions **44** and **58** of the weighted rollers **22** and **24**, respectively, provided by the eccentric mounting of the cylindrical portions are located relative to the buckets **18** and **20** whereby the rollers **22** and **24** operate to balance the vertical weight of the buckets **20** and **18**, respectively. In the second position thereof shown in FIG. **5**, as the buckets **18** and **20** begin moving in opposite rotations thereby to create a space therebetween, the weighted roller **22** rotates in a direction opposite to the direction of rotation of the bucket **18** while the weighted roller **24** is being rotated in a direction opposite to the direction of rotation of bucket **20**. Accordingly, the heavy portion **44** of weighted roller **22** counterbalances the horizontal weight of the bucket **18** and the heavy portion **58** of weighted roller **24** functions as a counterbalancing force to the horizontal weight of the bucket **20** as the latter rotates. In the middle position depicted in FIG. **5**, the heavy portion **44** of weighted roller **22** has been rotated to a position where it is effective to balance with the weight of the bucket **20** while the heavy portion **58** of weighted roller **24** is located so as to be in a position where it is operable to balance with the weight of the bucket **18**. In the fourth position thereof shown in FIG. **5** of the drawings, the heavy portion **44** of the weighted roller **22** has continued its rotation so that it now occupies a position wherein it is capable of balancing the weight of the bucket **18** and the heavy portion **58** of weighted roller **24** has been rotated so that is located in a position wherein it is effective to balance the weight of the bucket **20**. The positions of the weighted rollers **22** and **24** and the buckets **18** and **20** shown at the extreme right of FIG. **5** are the same as those shown at the extreme left of FIG. **5** and are presented for purposes of depicting the completion of a full 360° revolution of these elements. Thus, it should be clear with reference to the preceding description that the weighted rollers **22** and **24** co-act with the buckets **18** and **20** so that the former are continually able to provide a counterbalancing force to the forces being generated by the weight of the buckets **18** and **20** as the shafts **34** and **36** on which the buckets **18** and **20** are mounted are rotated.

In accord with the illustrated embodiment of the invention, the double bucket die cutting assembly **10** is preferably provided with a wheel **106** which when rotated is operable to cause the gears **104** and **106** to rotate. The rotation of the latter gears **104** and **106** is effective to also cause the buckets **18** and **20** and the weighted rollers **22** and **24** to be rotated through operation of the drive means **88**. The purpose of providing the assembly **10** with this manual capability to rotate the buckets **18** and **20** and the weighted rollers **22** and **24** is that is has been found that on occasions the buckets **18** and **20** and the weighted rollers **22** and **24** may be stopped in such a position that they bear a relationship to each other wherein the inertia needed to be overcome in order to cause them to begin rotating once again is substantial. Accordingly, when this condition is found to exist, it is possible through operation of the wheel **106** to rotate the buckets **18** and **20** and the weighted rollers **22** and **24** to a position wherein the relationship which they bear to each other is such that less inertia is required to be overcome for the rotation of the shaft **96** to be transmitted thereto. The construction of the double bucket die cutting assembly **10** as illustrated in the drawings and as described hereinabove provides the assembly **10** with a number of desirable features. In this regard, the assembly **10** is constructed so as to be capable of fitting as a complete unit into a die station of a press. This renders it unnecessary to provide additional lengths of web material to be utilized for purposes of threading the web material into the assembly **10** or for tensioning the web material and as such also obviates the problems involving registration occasioned thereby. Also, since the assembly **10** is being driven directly as a die would be, this also minimizes the problem of achieving registration between the web **110** of stock material and the punch bucket **18** and die bucket **20**. Another desirable feature possessed by the assembly **10** is that by virtue of the use therein of buckets for purposes of securing the punches and die means therein, it is relatively easy to change both of the latter. Thus, if it is desired to change the pattern of the hole being punched by replacing the punch and die sets being used, this is easily accomplished merely by changing the buckets. The alignment means **122** with which the assembly **10** is provided also provides the latter with another desirable feature, namely, that by virtue of the constant alignment which is capable of being achieved thereby, it is possible to provide virtually zero clearance between mating edges of the punch (not shown) and the die holes **40** thereby obtaining clear, fiberfree holes in the web of stock material. In the event it is desired to change the spacing by which repeat operations are performed on the web, there is embodied in the assembly **10** structure which permits this to be done simply by making two simple changes therein, namely, to change gears in the drive means **88** and the location of openings **26** and **28** in stub shafts

34 and 36, respectively. Finally, the double bucket die cutting assembly 10 of the present invention possesses the advantages of both linear and rotary motion. The advantage of rotary motion is the fact that the web enables the user to operate at a high degree of speed. The advantage of linear motion in the field of punch and die work is the fact that the waste is definitely removed from the web, i.e., there is no chance of waste being left in a cavity as often occurs when employing prior art devices. As high speeds are constantly being demanded by today's technology, greater is the requirement for balancing the moving parts of the device. In the assembly 10, the weight of the heavy portions 44 and 58 of the weighted rollers 22 and 24 can be calculated very precisely and the rollers 22 and 24 can be sized with as great an accuracy as is needed. Yet the rollers 22 and 24 can easily be changed to meet any change in job requirements, namely, a change in repeat and/or punch mass.

Although only one embodiment of a double bucket die cutting assembly constructed in accordance with the present invention has been shown in the drawings and described hereinabove, it is to be understood that modifications in the construction thereof may be made thereto by those skilled in the art without departing from the essence of the invention. In this connection, some of the modifications which can be made in the double bucket die cutting assembly 10 have been alluded to hereinabove while others will become readily apparent to those skilled in the art when exposed to the present description and illustration of the construction of the assembly 10. For example, though the assembly 10 has been described hereinabove as preferably being employed to perform punching operations such as punching small holes or long skinny holes, etc., in a continuously moving web of stock material, the assembly 10 is also capable of being employed to perform a variety of other forms of work operations. Thus, by replacing the punches supported on punch bucket 18 and the die means 38 on die bucket 20 with other suitable types of work performing means, the assembly 10 is capable of being employed to perform other work operations such as to apply paper reinforcements, to provide successive numbering, to do deep-set embossing, to string tags, to encapsulate items under a bubble, to apply heated plastic over dispenser items, etc. Moreover, though it has been found preferable to interconnect each end of the weighted rollers 22 and 24 and the buckets 18 and 20 together through gears in order to resist the torques generated during the rotation of the rollers 22 and 24 and the buckets 18 and 20, the gears which are supported for rotation in the frame member 16 may be omitted if so desired with some other form of means being utilized to resist the forces caused by the aforereferenced torques.

Thus, it can be seen that the present invention provides a novel and improved double bucket die cutting assembly which embodies a construction that enables an increase to be achieved in the speed with which operations are capable of being performed thereby. Moreover, the double bucket die cutting assembly of the present invention permits repeat operations to be performed in shortened lengths of stock travel. Furthermore, in accord with the present invention a double bucket die cutting assembly has been provided which is characterized by the fact that it is easily installed in conventional fashion in a press and occupies only limited space when mounted therein. The double bucket die cutting assembly of the present invention is capable of performing operations on a continuously moving web of stock thereby enabling stock to be fed through the assembly at a relatively high rate of speed. Also, in accord with the present invention a double bucket die cutting assembly has been provided which permits the buckets therein to be easily changed for purposes of altering the pattern produced by the assembly as a result of the operation thereof. Finally, the double bucket die cutting assembly of the present invention produces during the operation thereof a definite penetration in the stock thereby to effectively separate the waste from the latter stock.

Having thus described the invention, we claim:

1. A double bucket die cutting assembly, operable to perform a work operation on a length of material, comprising:

a. frame means including a pair of frame members;

b. bucket means mounted on said pair of frame members including first and second buckets having cooperating work performing means supported thereon, said bucket means also including first and second support means rotatably mounted on said frame and having the ends of said buckets eccentrically supported thereon for movement of said buckets to and from a closely spaced work performing position in which said work performing means cooperate to perform a work operation on a length of material passing therebetween, said work performing position of said buckets defining a work station;

c. counterbalancing means movably mounted on said pair of frame members operable to counterbalance the weight of said first and second buckets, said counterbalancing means including first and second rollers extending transversely between said frame members in spaced relation to said first and second buckets and on opposite sides of the plane defining said work station, and support means rotatably mounting said rollers on said frame for rotation about an axis substantially in the same plane as the axes of rotation of said buckets, said rollers having the weight thereof unequally distributed about their axes of rotation; and

d. drive means supported on said pair of frame members and operatively connected to said bucket means and said counterbalancing means for driving said first and second buckets to and from said work performing position and for moving said counterbalancing means in a predetermined manner to relative to said first and second buckets to cause said counterbalancing means to produce a firce effective to counterbalance the force produced by the weight of said first and second buckets during the movement thereof to and from said work performing position.

2. The double bucket die cutting assembly as set forth in claim 1 further comprising alignment means supported on said bucket means including a pair of pins interconnecting said first and second buckets operable for maintaining the proper alignment between said first and second buckets during the movement thereof.

3. The double bucket die cutting assembly as set gorth in claim 1 wherein said drive means includes a first set of gears interconnecting one end of each of said first and second buckets and said first and second rol-

lers, and a second set of gears interconnecting the other end of each of said first and second buckets and said first and second rollers.

4. The double bucket die cutting assembly as set forth in claim **3** further comprising override clutch means supported on said frame means operatively connected toi said drive means to permit said drive means to slip during a malfunction of the assembly.

5. The double bucket die cutting assembly as set forth in claim **1** wherein said first and second rollers each comprise a shaft having a cylindrical element eccentrically supported thereon.

6. A double bucket die cutting assembly, operable to perform a punching operation on a continuous web of material, comprising:

a. frame means including a pair of frame members;

b. bucket means including first and second buckets and first and second support means rotatably mounted on said frame and having said first and second buckets supported eccentrically thereon to permit said first and second buckets to undergo both linear and rotational motion in moving to and from a closely spaced work performing position, said first and second buckets having cooperating work performing means supported thereon operable to perform a punching operation on a continuous web of material passing therebetween when said first and second buckets are at said work performing position defining a work station;

c. counterbalancing means movably mounted on said frame means including first and second rollers extending transversely between said frame members and support means rotatably mounting said first and secoind rollers on said frame means on opposite sides of the plane defining said work station in spaced relation to said first and secoind buckets, said support means rotatably mounting said rollers for rotation about axes substantially in the same plane as the axes of said rotation of said buckets, said rollers having the weight thereof unequally distributed about their axes of rotation, the orientation of the heavier weight portion of the rollers relative to the cooperating buckets being adjusted and operable to counterbalance the weight of said first and second buckets during the rotation thereof; and

d. drive means supported on said pair of frame members and operatively connected to said bucket means and said counterbalancing means for driving said first and second buckets to and from said work performing position and for moving said first and second weighted rollers in a predetermined manner relative to said first and second buckets to cause said counterbalancing means to produce a force effective to counterbalance the force produced by the weight of said first and second buckets during the movement thereof to and from said work performing position.

7. The double bucket die cutting assembly as set forth in claim **6** wherein said first and second rollers each comprise a shaft having a cylindrical element eccentrically supported thereon.

8. the double bucket die cutting assembly as set forth in claim **6** further comprising alignment means supported on said bucket means including a pair of pins interconnecting said first and second buckets operable for maintaining the proper alignment between said first and second buckets during the movement thereof.

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