

June 2, 1936.

R. N. CUNDALL ET AL

2,043,094

SEWING MACHINE

Filed Sept. 26, 1933

5 Sheets-Sheet 1

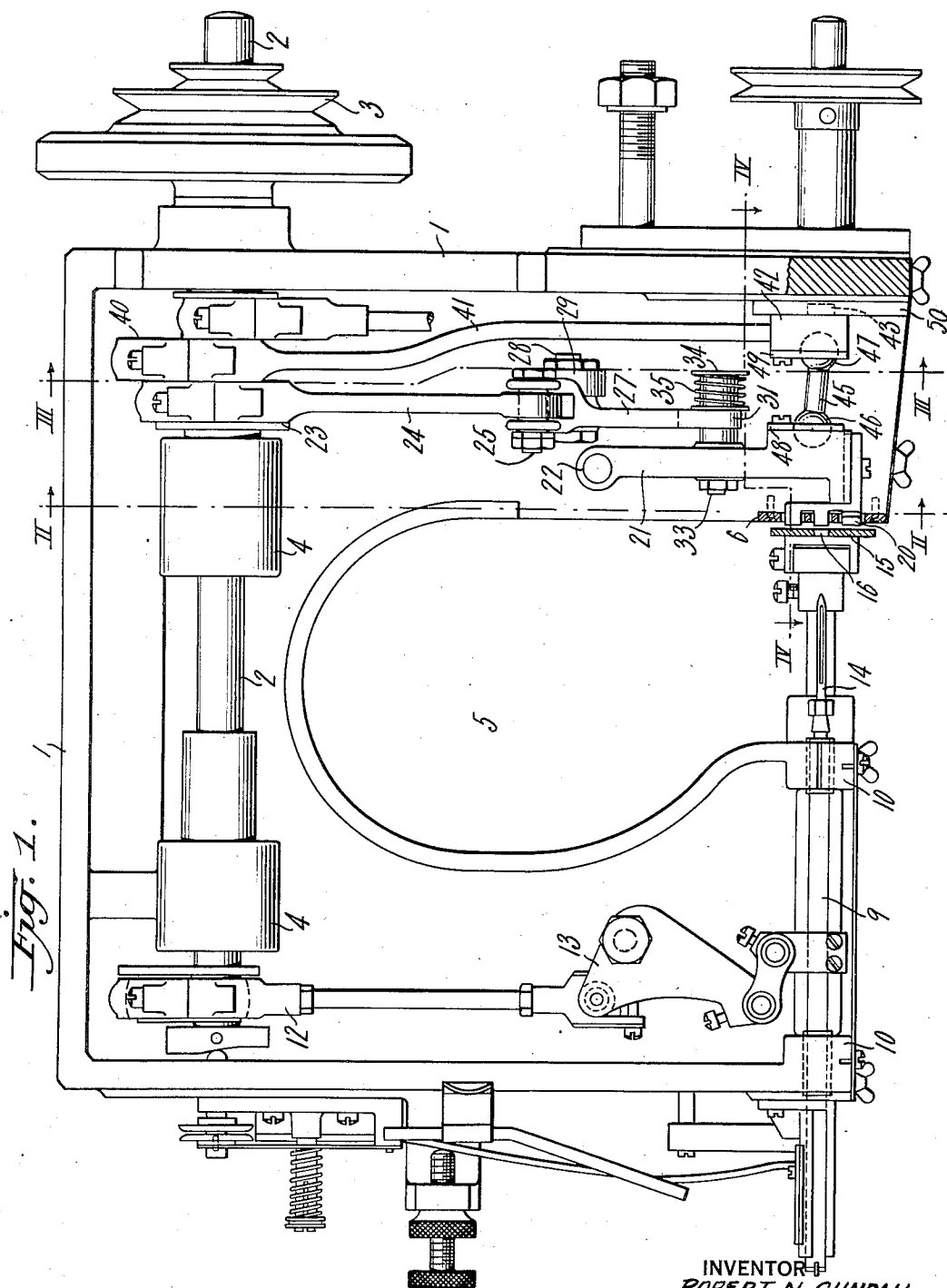


Fig. 1.

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SEWING MACHINE

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5 Sheets-Sheet 2

Fig. 3.

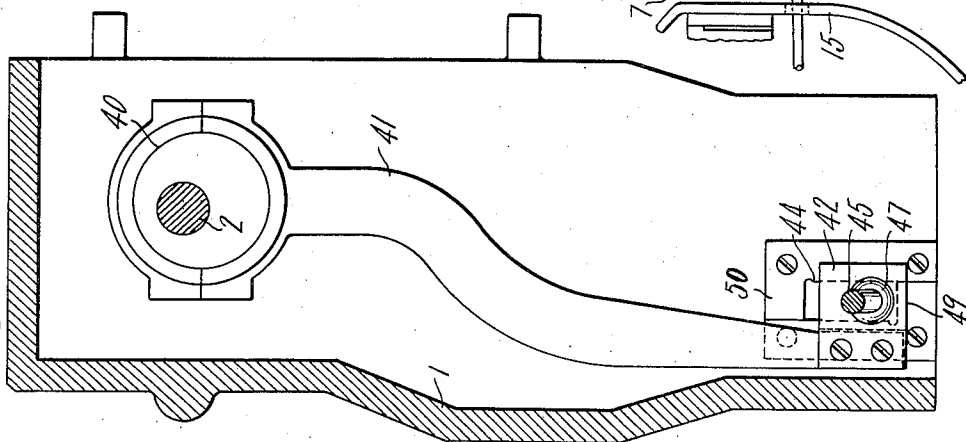


Fig. 6.

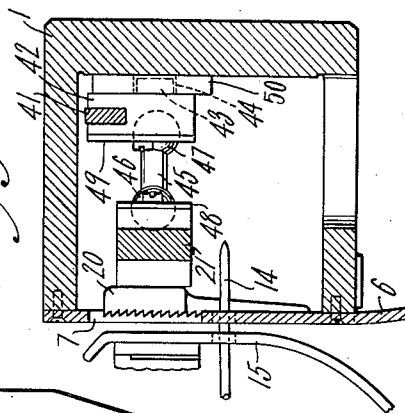
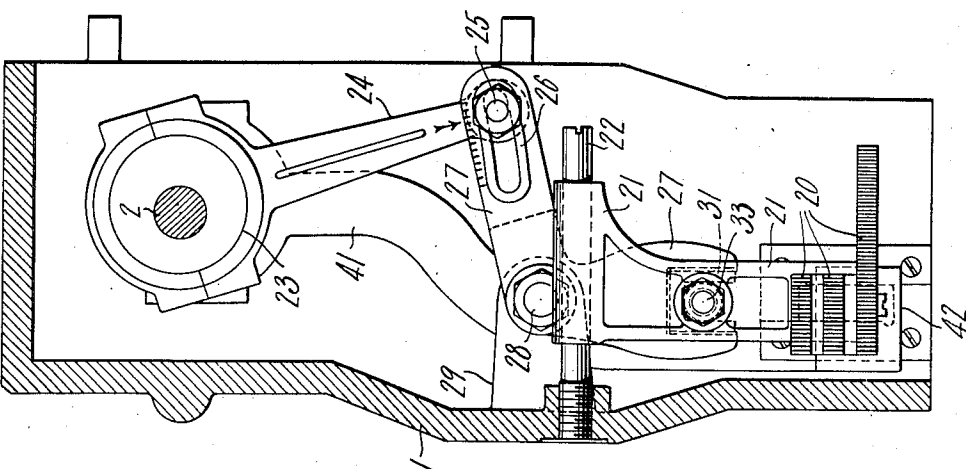


Fig. 2.



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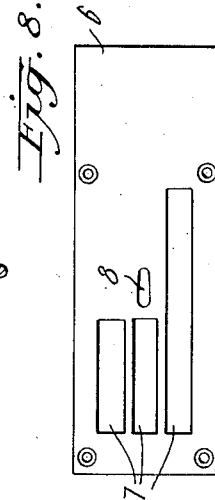
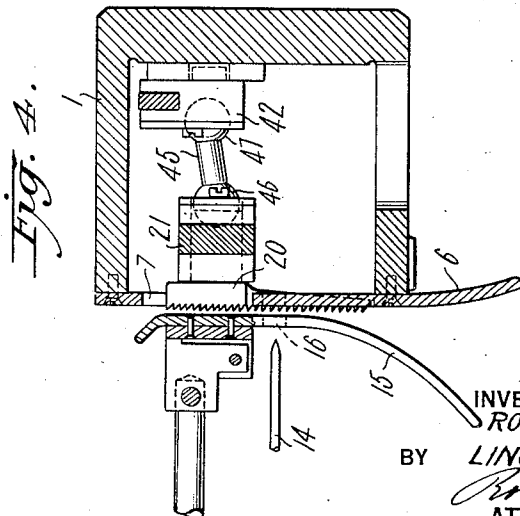
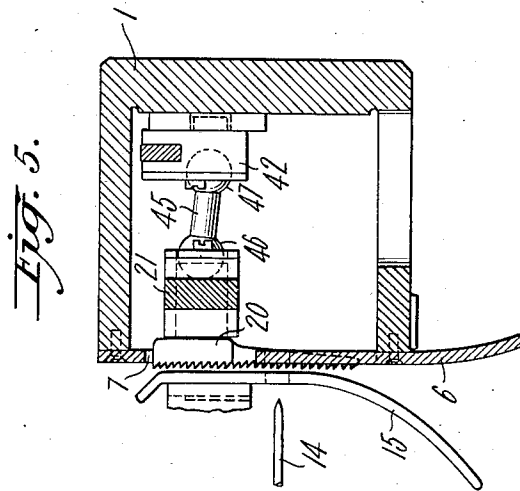
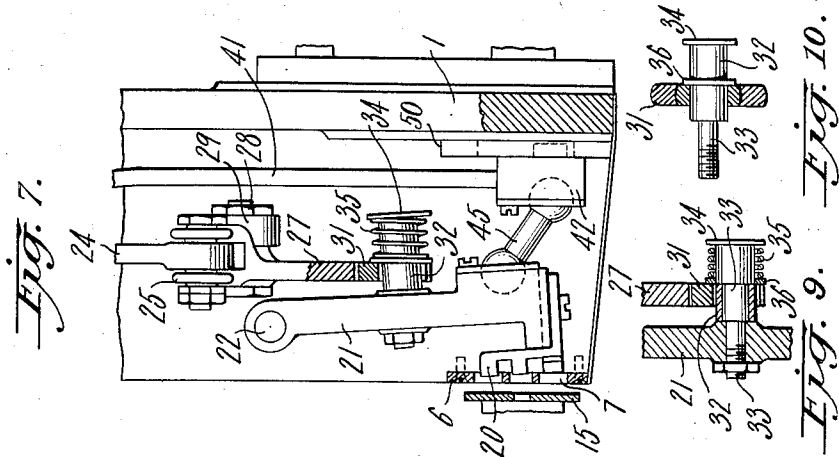
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SEWING MACHINE

Filed Sept. 26, 1933

5 Sheets-Sheet 3



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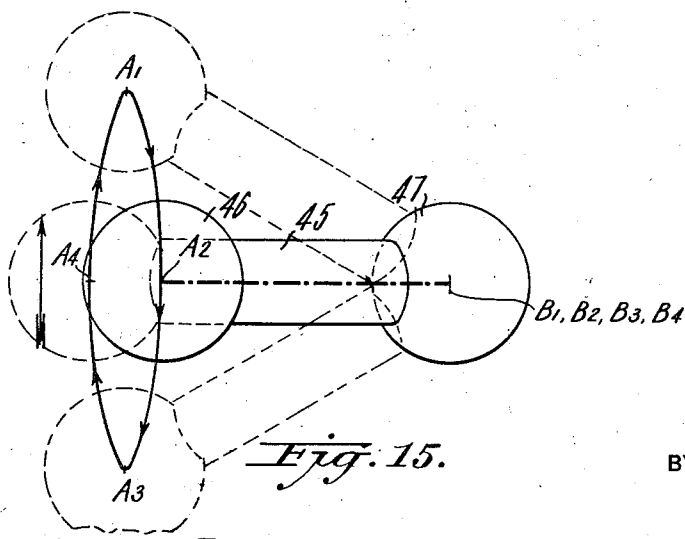
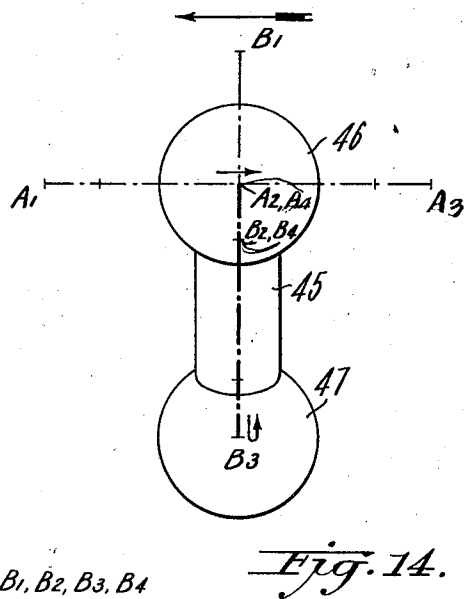
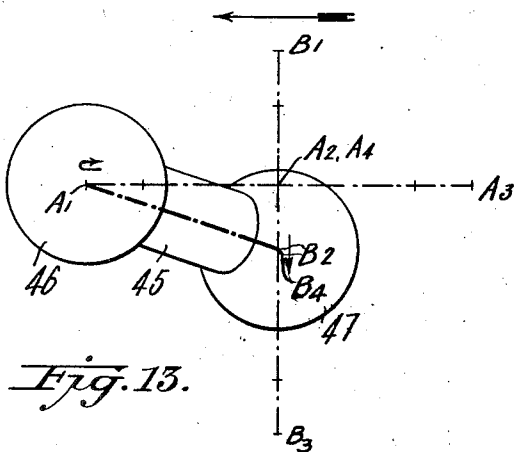
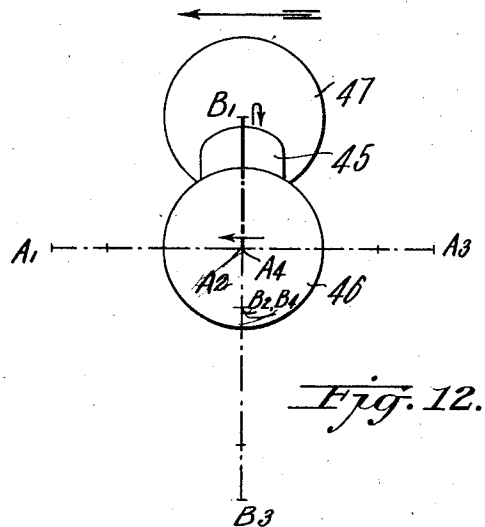
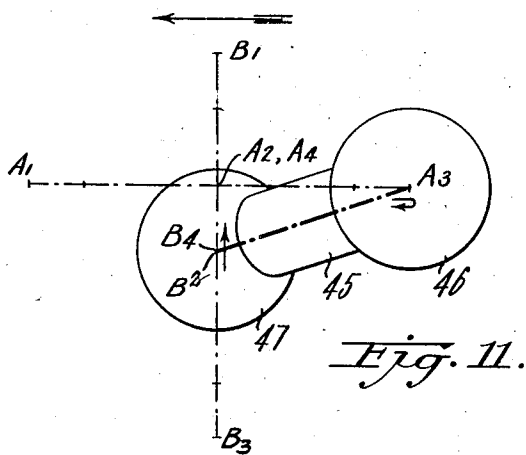
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2,043,094

SEWING MACHINE

Filed Sept. 26, 1933

5 Sheets-Sheet 4



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2,043,094

SEWING MACHINE

Filed Sept. 26, 1933

5 Sheets-Sheet 5

Fig. 16.

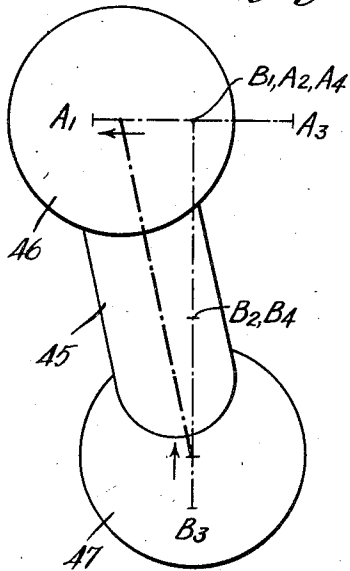


Fig 17.

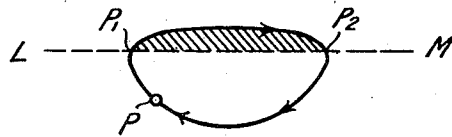


Fig. 18.

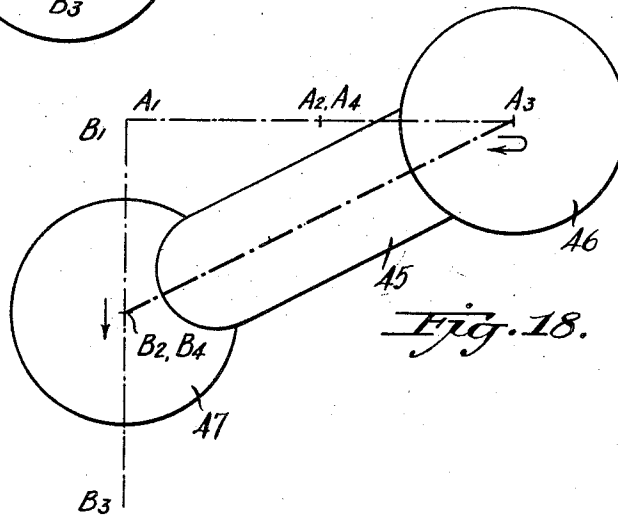
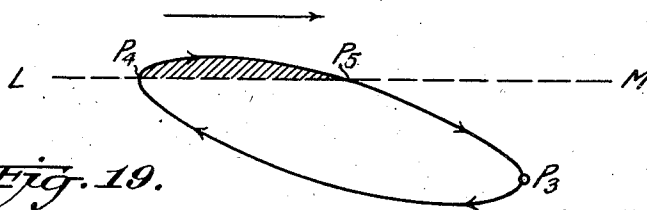


Fig. 19.



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UNITED STATES PATENT OFFICE

2,043,094

SEWING MACHINE

Robert N. Cundall, Lackawanna, and Lincoln A. Cundall, Buffalo, N. Y., assignors to Consolidated Packaging Machinery Corporation, Buffalo, N. Y., a corporation of New York

Application September 26, 1933, Serial No. 690,988

20 Claims. (Cl. 112—215)

Our invention relates to sewing machines and is of special utility with reference to machines for sewing heavy material, such, for example, as machines for sewing the mouths of paper bags. Such bags are frequently intended to hold as much as 100 lbs. or more of material and may be made of heavy kraft paper or the like, of multiply construction. We have found that machines capable of sewing the mouths of such bags must be extremely rugged and durable.

Our invention has for an object the provision of a sewing machine capable of use on heavy material of the character indicated, which is possessed of the requisite strength and rigidity, is simple in construction, and the moving parts of which are of relatively low inertia so that the machine may be driven uniformly at a high rate of speed without excessive power consumption and without excessive vibration.

It is also found that whereas in previous sewing machines which operated satisfactorily on cloth bags, slight inaccuracies of movement of the feeding mechanism would not produce serious difficulties in sewing cloth by reason of the more or less flexible or sleazy character of cloth as compared with paper, when such machines were employed for the stitching of heavy paper bags, or the like, such irregularity of movement tended to produce irregular and defective stitching, as the relatively stiff and rigid paper did not accommodate itself to any irregularity of movement. It is therefore a further object of our invention to provide a sewing machine having a feeding mechanism which, in addition to being sufficiently strong and rugged to handle heavy and stiff material, is accurate in operation and lends itself to the handling of heavy and stiff material such as paper.

More particularly our invention contemplates the provision of improved feed dog actuating means constituting an improvement over the invention set forth in the copending application of Howland F. Briggs and Robert N. Cundall, Ser. No. 689,400, filed September 14, 1933.

Such mechanism is especially adapted to be employed in connection with driving mechanism comprising a main drive shaft extending parallel to the principal axis of the needle and having eccentric means mounted thereon for the purpose of driving the feeding mechanism as well as other moving parts of the machine, and the sewing machine of our invention is also especially adapted to be employed in conjunction with mechanisms for filling and closing open-mouth bags as those described and claimed in the copending applica-

tion of Robert N. Cundall, Ser. No. 640,758, filed November 2, 1932, and the copending applications of Robert N. Cundall and Lincoln A. Cundall, Ser. Nos. 666,114 and 688,816, filed April 19, 1933 and September 9, 1933, respectively.

With respect to this and other apparatus, it is desired to point out that, while the feeding mechanism is referred to herein as being for the purpose of advancing the material through the sewing machine, it is not absolutely essential that the actual forward motion of the material be caused by the feeding mechanism, as this motion may be effected by other means and the feeding mechanism may actually cause the sewing machine to travel along the paper, whether the latter is stationary or in motion. In any event, however, the function of the feeding mechanism is to assist in producing a relative movement of the material being sewn with respect to the sewing machine and it is immaterial in so far as our present invention is concerned whether the one or the other is actually caused to move by the feeding mechanism.

Thus, in sewing the mouths of previously filled bags, especially bags adapted to contain large amounts of materials, it is not ordinarily feasible to move the bags along in an intermittent jerking movement, and the relatively stiff and rigid paper allows for no movement of the paper relative to the head while the needle is engaged with the paper during stitching.

As shown in the aforesaid copending applications of Robert N. Cundall and Lincoln A. Cundall, a sewing head for such use may be pivotally mounted on an axis normal to the plane of the material being sewn, the head being rocked about this axis as the paper advances, or as the head is moved along the paper, as the case may be.

Our invention is therefore especially adapted to be employed in a sewing head of this character, in which the various moving parts are driven from a main drive shaft having its axis parallel to that of the needle and having eccentric means for actuating the needle, the feeding mechanism and the looper mechanism. Such a head, when employed for stitching the mouths of previously filled bags, and, it may be, for other purposes as well, is preferably pivotally mounted on an axis passing through the center of gravity of the head or coaxial with the drive shaft as fully illustrated and described in each of said aforementioned applications, but in any event normal to the plane of the material being sewn.

Our invention has for a second object the provision of improved means for effecting the rela-

tive advancement through a sewing machine of the material to be sewed.

Our invention has for further objects such other improvements in construction and operative results as may hereinafter be found to obtain.

In order that our invention may clearly be set forth and understood, we now describe, with reference to the drawings accompanying and forming part of this specification, various preferred forms and manners in which our invention may be embodied and utilized, but without limiting ourselves to the details of such exemplifications. In these drawings,

Fig. 1 is an elevational view of a sewing machine constructed in accordance with our invention, with a portion of the usual exterior casing and some other conventional parts removed for the sake of clarity;

Figs. 2 and 3 are vertical sectional views of the apparatus shown in Fig. 1, taken along lines II—II and III—III of Fig. 1, respectively;

Fig. 4 is a horizontal sectional view of a portion of the apparatus shown in the preceding figures, taken along the line IV—IV of Fig. 1;

Figs. 5 and 6 are views of that portion of the apparatus shown in Fig. 4, taken similarly to Fig. 4, but with parts thereof in different positions from that in which they are shown in Fig. 4;

Fig. 7 is a view of a portion of the mechanism shown in Fig. 1, taken similarly to Fig. 1, but illustrating certain parts of the apparatus in a different position from that in which they are shown in Fig. 1;

Fig. 8 is a detailed elevational view of a portion of the apparatus shown in Fig. 1;

Figs. 9 and 10 are detailed views in vertical and horizontal sections, respectively, of a portion of the apparatus shown in Figs. 1, 2, and 7;

Figs. 11 to 15 are intended to illustrate diagrammatically the motion of a portion of the apparatus shown in the preceding figures;

Figs. 16 and 17 are views intended to illustrate diagrammatically a different motion-characteristic of portions of the apparatus shown in the preceding figures; and

Figs. 18 and 19 are views similar to Figs. 16 and 17, respectively, illustrating a still further motion-characteristic.

Similar reference numerals designate the same or similar parts in the several views of the drawings.

Referring now to the drawings, and in particular to Fig. 1, there is illustrated a sewing machine having a main frame 1 and a main shaft 2 carrying a pulley 3 and journaled in bearings 4 mounted inwardly of the main frame 1.

The casing and frame of the sewing machine are provided with an opening 5 to permit the passage of material through the machine. A feed plate 6 is attached to the frame 1 at the throat of the opening 5, this feed plate having feed-dog slots 7 and a needle slot 8. Opposite the needle slot 8 there is mounted a needle bar 9 which is adapted to be reciprocated through bearings or guides 10 by means of an eccentric 12 mounted upon the end of the shaft 2 and connected to the needle bar 9 through a bell crank 13 and appropriate linkage. The end of the needle bar 9 adjacent the feed plate 6 is provided with the usual needle 14. A yieldably mounted presser foot 15 having a slot 16 is provided which is capable of adjustment with respect to the feed plate 6.

For the purpose of advancing the material to

be sewed through the space lying between the presser foot 15 and the throat plate 6, there is provided a feed dog 20, the face or faces of which are preferably serrated or otherwise roughened to facilitate the movement of the material. The feed dog 20 is mounted upon an arm 21, the upper end of which is in turn slidably mounted upon a pin 22 extending from the casing 1, the mounting being such that the arm 21 may be moved longitudinally with respect to the pin 22 or may be rocked about the pin 22 as an axis.

The pin 22 lies in a plane parallel to that of the feed plate 6, and also extends parallel to the direction of the material passing through the machine, as it is the sliding motion of the arm 21 along the pin 22 which causes the feed dog 20, during a portion of the path of the latter, to advance the material through the machine.

For the purpose of reciprocating the arm 21 and feed dog 20 longitudinally with respect to the pin 22, we provide an eccentric 23 suitably located on the shaft 2 and connected by means of a crank arm 24 to a pin 25 fastened in a slot 26 located in one arm of a crank member 27 which is pivotally mounted on a pin 28, the axis of which is perpendicular to the plane of the feed plate 6, and which is conveniently attached to a lug 29 extending inwardly from the main frame 1. The pin 25 may be fastened at various distances from the pivot 28 in the slot 26 and the latter may conveniently be graduated, as shown, to indicate different lengths of stroke which correspond to different positions of the pin 25 in the slot 26. It will become apparent from the description of the apparatus that the distance from the pin 28 to the pin 25 determines or influences the length of stroke of the feed dog 20 and consequently the distance which the material being sewed is caused to advance between successive stitches made by the needle 14.

The opposite end of the bell crank 27 is provided with a yoke portion 31 adapted to receive a cylinder 32 enclosing a pin 33 which is in turn fastened to the arm 21, preferably at or near the mid-portion thereof. The pin 33 is provided with a head 34 and a spring 35 acts through a washer 36 against the crank 27 to exert a force upon the head 34 tending to draw the arm 21 into the position in which it is shown in Fig. 7. In this position, the feed dog is retracted out of the space lying between the feed plate 6 and the presser foot 15, and is thus out of engagement with the material being sewed, which is held between the presser foot 15 and the feed plate 6.

As the shaft 2 revolves, the action of the eccentric 23 causes the crank 27 to oscillate about the pin 28, thus sliding the arm 21 to and fro along the pin 22 and causing the feed dog 20 to reciprocate longitudinally with respect to the slots 7 in the feed plate 6.

Mounted upon the main shaft 2 is a second eccentric 40, which is connected by means of a crank arm 41 to a block 42 having a lug 43 adapted to reciprocate in a vertical way or groove 44 in a plate 50 mounted on the main frame 1. The groove 44, as shown, lies in a plane parallel to that of the feed plate 6, and is perpendicular to the principal axis of the pin 22.

The lower end of the arm 21 and the block 42 are connected by means of a "dumb-bell" link 45 having spherical ends 46 and 47 held in semi-spherical sockets provided in the arm 21 and the block 42 by means of plates 48 and 49, respectively.

The link 45 forms a positive connection between the arm 21 and the block 42, and as the feed dog 20 advances the material being sewed, causes the latter to exert a strong positive force against the material. The manner in which the feed dog 20 is caused to move by the eccentrics 23 and 40 and the link 45 may best be understood by reference to Figs. 4, 5, 6 and 11 to 19, inclusive.

In each instance it will be understood that the arm 21 performs one complete forward and backward motion along the pin 22 in the time required for the block 42 to perform one complete upward and downward movement. In Figs. 11 to 14, the link 45 is viewed from the plane of the material being sewed, while Fig. 15 is a plan view.

In Figs. 11 to 14, the extreme limits of travel of the center of the head 46 of the arm 45 are indicated at A₁ and A₃. A₂ represents a point half-way across the backward stroke of the arm 21, while A₄ represents a point half-way across the forward travel of the arm 21, the points A₂ and A₄ coinciding. The arrow indicates the direction of motion of the material being sewed, which is forward.

Similarly, the points B₁ and B₃ represent the extreme upper and lower ends, respectively, of the stroke of the center of the head 47 of the link 45. B₂ represents a point half-way on the downward stroke of the head 47, while B₄ represents a point half-way on the upward stroke, the points B₂ and B₄ coinciding.

It will be observed that, in the instance illustrated in Figs. 11 to 14, the points B₂ and B₄, as viewed in these figures, lie below and to the rear of the points A₂ and A₄, the exact position being of considerable importance, as will be shown hereinafter.

In Fig. 11, the head 46 has reached the end of its right-hand or backward stroke at A₃, and is about to move forward, while the head 47 is moving upward at B₄. At this time, the feed-dog 20 is moving through the feed plate 6 into engagement with the material being sewed, and is about to grip and advance the material. The position shown in Fig. 4 follows that shown in Fig. 11 very shortly thereafter.

In Fig. 12, the head 46 is half-way across its forward stroke at A₄, and the head 47 has reached the top of its upward stroke at B₁, and is about to descend. The feed-dog 20 is advancing the material being sewed through the space between the feed plate 6 and the presser foot 15 in the direction of the arrow. The position shown in Fig. 5 occurs somewhat later, toward the end of the forward stroke of the feed dog 20.

In Fig. 13, the head 46 has reached the end of its forward stroke at A₁, while the head 47 is moving downward at its maximum rate of travel at B₂. The feed-dog 20 is being retracted through the feed plate 6 and is passing out of engagement with the material and about to move backward for a new stroke.

In Figs. 14 and 15, as well as in Fig. 6, the head 46 is moving backward at its maximum rate of travel at A₂, and the head 47 has reached the end of its downward stroke at B₃. The feed dog 20 has been retracted behind the feed plate 6 out of engagement with the material being sewed and is moving back for another forward stroke. The material is now stationary and being stitched. The relative timing of the eccentrics 12, 23, and 40 is such that the needle 14 makes its stitches, i. e., traverses the material lying between the presser foot 15 and the feed plate 6, during such times as the feed dog 20 is retracted through the

feed plate 6 out of contact with the material being sewed. The stitching thus takes place during the portion A₁, A₂, A₃ of the path of the head 46 of the link 45 shown in Fig. 15. Thus, as the head 46 passes the point A₁, the needle 14 moves forward, piercing the material and cooperating with a looper (not shown) to form a stitch. The needle 14 is withdrawn from the material before the head 46 reaches the point A₃, when the feed dog 20 again moves out through the feed plate 6 and forward, advancing the material to the proper point for the next stitch.

The path of the feed-dog 20 is, of course, similar to that of the head 46 as indicated by the line A₁, A₂, A₃, A₄, of Fig. 15.

The characteristics of the curve A₁, A₂, A₃, A₄ are considerably affected by the relative positions and lengths of the paths of movement of the heads 46 and 47. While the motion-characteristic which is illustrated in the preceding figures, and more particularly in Figs. 11 to 15, is simple and lends itself readily to explanation, we have found that numerous different characteristics may be obtained which have advantages for different purposes.

Thus, in Figs. 16 and 17 we have illustrated diagrammatically a motion-characteristic which has been found especially suitable in practice. In Fig. 16, which is a view taken in the plane of the material being stitched, it will be observed that the path A₁, A₃ of the head 46 is one-half as long as the path B₁, B₃ of the head 47, and, as viewed in Fig. 16, the point B₁ lies directly behind the points A₂ and A₄. In a typical instance the path A₁, A₃ of the head 46 may be $\frac{1}{4}$ " long, while the path B₁, B₃ of the head 47 is $\frac{1}{2}$ " long, the distance between stitches being $\frac{1}{4}$ ". In this instance, the eccentric 23 leads the eccentric 40 by 90° of rotation. In Fig. 16, the link 45 is shown with the head 46 moving to the left midway between points A₄ and A₁ and the head 47 moving up midway between points B₃ and B₄. The adjustment of the length of the path A₁, A₃ is obtained by shifting pin 25 in the slot 26 (Fig. 2). The raising of path A₁, A₃ with respect to path B₁, B₃ may be obtained by shortening the distance between pins 28 and 33 to thus raise head 46, but is best obtained by increasing the effective length of arm 41 to thus lower head 47.

In Fig. 17, the motion of the feed dog which results from the setting and relation illustrated in and described with reference to Fig. 16 is diagrammatically illustrated. This view is assumed to be in plan, the line L—M designating the position of the face of the feed plate 6. The curved path P, P₁, P₂ is the path described by the feed-dog 20. The point P illustrates the position of the feed dog corresponding to the position of the link 45 illustrated in Fig. 16, while the shaded portion of the figure enclosed by the line P₁, P₂, lying above the line L—M illustrates that portion of the stroke in which the feed dog extends through the feed plate 6 and advances the material. The distance between the points P₁ and P₂ along line L—M establishes the distance between stitches, which in the present instance is $\frac{1}{4}$ ", corresponding to the length of path A₁, A₃.

By offsetting the paths of the heads 46 and 47 of the link 45, paths of considerably different characteristics may be obtained, and in Figs. 18 and 19, we have illustrated a further motion-characteristic which may thus be obtained. Assuming that the distance between stitches is to be $\frac{1}{4}$ ", the path A₁, A₃ of the head 46 and the path B₁, B₃ of the head 47 are each made $\frac{1}{2}$ "

long, and the point B₁ lies directly behind the point A₁ as viewed in Fig. 18.

The adjustment of path A₁, A₃, to obtain the feed-dog characteristics illustrated in Fig. 19, is accomplished by shifting pin 25 in slot 26 away from the pivot 23 of crank 27 to about the maximum distance permitted by said slot. Pin 25 is, of course, movable in either direction in slot 26 to obtain other variations in characteristics of the feed-dog, but the shifting, as described in the preceding sentence, applies to the obtaining of the setting illustrated in Fig. 18 and resulting in the feed-dog characteristics illustrated in Fig. 19. The offsetting of path B₁, B₃, from the position at the center of path A₁, A₃, (illustrated in Figs. 11, 12, and 13) to a position at one end of path A₁, A₃, (illustrated in Fig. 18) is obtained by shifting plate 50, in which is mounted head 47 of the dumb-bell link 45, toward the left of Fig. 3. A similar result would be obtained if provision were made to shift pivot 28 toward the right of Fig. 2, or pin 33 toward the right of Fig. 2. However, since the feed-dog must maintain a definite relation with respect to the needle and other parts, it is necessary to shift the end of the dumb-bell link which is not attached to the feed-dog.

The motion-characteristic of the feed dog 20 which corresponds to the arrangement and setting shown in Fig. 18 appears in Fig. 19 as the path P₃, P₄, P₅, the point P₃ representing the position of the feed dog 20 which corresponds to the position of the link 45 illustrated in Fig. 18, and the points P₄ and P₅ illustrating the points at which the feed dog 20 passes through the feed plate 6 into and out of engagement, respectively, with the material being sewed.

The distance between the points P₄ and P₅ on the line M—L thus corresponds to the distance between successive stitches, and it will be observed that this distance is approximately one-half of the length of the path A₁, A₃. It will therefore be obvious that, whereas in the instance illustrated in Figs. 16 and 17, forward motion of the material being sewed occupied 180° of rotation of the shaft 2, in the instance illustrated in Figs. 18 and 19, forward motion of the material being sewed occupies only 90° of rotation of the shaft 2, leaving 270° of rotation of the shaft 2 for the actual sewing operation.

Since the stitching of the material occurs as the feed dog travels from the point P₅, through the point P₃ to the point P₄, and since this portion of the path, as aforesaid, occupies 270°, (instead of 180° as in the instances described hereinabove), of one complete rotation of the shaft 2, it will be obvious that in this instance, for a given time required to make a stitch, the shaft 2 may be driven faster than in the other instances given hereinabove, and consequently the speed of the machine, in stitches per minute, is thus increased.

It is to be appreciated that several alterations of the various parts may be utilized to vary the path of the feed dog. Thus, by varying the respective lengths of the vertical leg of member 27 and member 41, the line B₁, B₃ may be raised or lowered with respect to line A₁, A₃. Similarly, by moving guide 50 laterally from the position shown in Fig. 3, line B₁, B₃ may be shifted laterally with respect to line A₁, A₃. However, it is to be noted that for most purposes the simple readily operable adjustment provided by our invention is sufficient. That is, with the lengths of members 27 and 41 fixed and guide 50 fixed, adjustment of the pivot 25 will suffice for most

circumstances. By means of this simple adjustment, paths such as A₁, A₂, A₃, A₄, (Fig. 15), P₁, P₂, (Fig. 17), or P₃, P₄, P₅, (Fig. 19) may be shortened or lengthened to vary the distance between needle punctures and the length of thread loops or stitches.

With reference to the diagrams of Figs. 11, 12, 13, 14, 16, and 18, it is to be noted that while the paths A₁, A₂, A₃, A₄ of the head 46 of the link 45 are, for purposes of simplification, shown as straight lines, these paths are in fact slightly curved, due to the rocking of the arm 21 about the pin 22. This deviation from a purely two-dimensional path will depend, of course, upon the distances between the pin 22, the head 46 and the feed dog 20, but is ordinarily negligible in effect and scope, and need not be considered at length.

It will be understood that the sewing machine illustrated in the drawings is provided with the usual auxiliary mechanism, including devices for supplying thread to the needle 14, for maintaining tension on the thread, and the like, which devices constitute no part of the present invention and do not require detailed description.

It will further be understood by those skilled in the art that our invention is susceptible of considerable modification in detail, and is therefore not limited to the specific details of the illustrative examples set forth and described hereinabove by way of exemplification, but may variously be embodied and utilized within the scope of the claims hereinafter made.

We claim:

1. In a sewing machine, a feed dog, means for reciprocating said feed dog substantially in the line of motion of the material being sewed, a link abutting against said feed dog at one end, and means for reciprocating the other end of said link in a plane parallel to the plane of the material being sewed, whereby the feed dog is caused to perform a series of alternate forward motions in engagement with said material and reverse motions out of engagement with said material, the material being thereby advanced in a series of intermittent movements.

2. In a sewing machine, a feed dog, means for reciprocating said feed dog substantially in the line of motion of the material being sewed, a link abutting against said feed dog at one end, and means for reciprocating the other end of said link in a plane parallel to the plane of the material being sewed, whereby the feed dog is caused to perform a series of alternate forward motions in engagement with said material and reverse motions out of engagement with said material, the material being thereby advanced in a series of intermittent movements, and means for stitching said material in the intervals between successive forward movements.

3. In a sewing machine, a feed dog adapted to be reciprocated substantially in the line of motion of the material being sewed, a member adapted to be reciprocated in a plane parallel to and at a fixed distance from the plane of said material, and a link pivoted at one end to the feed dog and at the other end to said member, whereby the feed dog is caused to perform a series of alternate forward motions in engagement with said material and reverse motions out of engagement with said material, the material being thereby advanced in a series of intermittent movements.

4. In a sewing machine, a feed dog pivoted on an axis parallel to the line of motion of the material being sewed, a member located in a plane

parallel to the plane of the material being sewed, a link pivotally attached to one end to the feed dog and at the other end to said member, means tending to reciprocate said feed dog substantially in parallelism to the line of motion of said material, and means for reciprocating said member in its plane substantially at right angles to the line of reciprocation of said feed dog, whereby the feed dog is caused to perform a series of alternate forward motions in engagement with said material and reverse motions out of engagement with said material, the material being thereby advanced in a series of intermittent movements.

5. In a sewing machine, a main driving shaft, a second shaft extending parallel to the line of motion of the material being sewed, a feed dog arm slidably mounted on said second shaft, an eccentric mounted on said main driving shaft adapted to reciprocate said feed dog arm along said shaft, a member located in a plane parallel to that of the material being sewed, a link separating said feed dog arm and said member, and a second eccentric mounted on said main drive shaft for reciprocating said member in its plane, thereby reciprocally moving said feed dog arm about said second shaft during its reciprocal movement along said shaft, whereby the free end of the feed dog arm is caused to move through a closed two-dimensional path located substantially in a plane perpendicular to that of the material being sewed.

6. In a sewing machine, a feed dog, a link for controlling the movement of said feed dog, means for reciprocating one end of said link along an axis located in a plane parallel to the plane of the material being sewed, and means for reciprocating the other end of said link substantially in a plane perpendicular to the axis of reciprocation of said first-mentioned end, the periods of reciprocation of said ends being equal.

7. In a sewing machine, a feed dog, a link for controlling the movement of said feed dog, means for reciprocating one end of said link along an axis located in a plane parallel to the plane of the material being sewed, and means for reciprocating the other end of said link substantially in a plane perpendicular to the axis of reciprocation of said first-mentioned end, the periods of reciprocation of said ends being equal and the mid-points of the reciprocal paths of travel of said ends being offset with respect to a line normal to the plane of said material.

8. In a sewing machine, a feed dog, a link for controlling the movement of said feed dog, means for reciprocating one end of said link along an axis located in a plane parallel to the plane of the material being sewed, and means for reciprocating the other end of said link substantially in a plane perpendicular to the axis of reciprocation of said first-mentioned end, the periods of reciprocation of said ends being equal, the mid-points of the reciprocal paths of travel of said ends lying in a plane normal to the line of movement of said material but in a single plane perpendicular to the plane of said material.

9. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, a feed dog operating through said feed plate, and feeding mechanism comprising an arm pivotally and slidably mounted at one end on an axis parallel to the direction of movement of said material and carrying said feed dog at the other end thereof, a reciprocating member located in a plane parallel to the plane of the ma-

terial being sewed at a fixed distance therefrom, a link pivotally connected at its ends to said arm and said reciprocating member, respectively, a lever pivotally mounted on an axis perpendicular to the plane of the material being sewed and attached to said arm, and an eccentric for rocking said lever about its axis, whereby said feed dog is caused to act through said feed plate to advance the material being sewed in a series of short intermittent movements.

10. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member adapted to be reciprocated along an axis parallel to the direction of movement of the material being sewed, a second member adapted to be reciprocated along a line perpendicular to said axis and in a plane parallel to the plane of the material being sewed, and a link pivotally attached at its end to said feed dog member and said second member, respectively, whereby said feed dog member is caused to act through said feed plate to advance the material being sewed in a series of short intermittent movements.

11. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member adapted to be reciprocated along an axis parallel to the direction of movement of the material being sewed, a second member adapted to be reciprocated along a line perpendicular to said axis and in a plane parallel to the plane of the material being sewed, and a link pivotally attached at its end to said feed dog member and said second member, respectively, whereby said feed dog member is caused to act through said feed plate to advance the material being sewed in a series of short intermittent movements, and means for varying the path of reciprocation of said feed dog member along said axis.

12. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member mounted on an axis parallel to the direction of movement of the material being sewed, a vertically reciprocating member adapted to rock said feed dog member about said axis, and an eccentric device adapted to reciprocate said feed dog member along its axis, whereby said feed dog member is caused to move through a substantially two-dimensional closed path and to act through said feed plate during a portion of said path to advance the material being sewed.

13. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member mounted on an axis parallel to the direction of movement of the material being sewed, a vertically reciprocating member adapted to rock said feed dog member about said axis, a lever pivotally mounted on an axis perpendicular to the plane of the material being sewed and pivotally connected to said feed dog member, and an eccentric device pivotally connected to said lever and adapted to act through said lever to reciprocate said feed dog member along its axis.

14. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member mounted on an axis parallel to the direction of movement of the material being sewed, a vertically reciprocating member adapted to rock said feed dog member about said axis, a lever pivotally mounted on an axis perpendicular to the plane of the material being sewed and piv-

otally connected to said feed dog member, an eccentric device adapted to act through said lever to reciprocate said feed dog member along its axis, and means for varying the extent of motion of said lever affected by said eccentric device.

15. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member mounted on an axis parallel to the direction of movement of the material being sewed, a vertically reciprocating member adapted to rock said feed dog member about said axis, a crank pivotally mounted on an axis perpendicular to the plane of said feed plate and pivotally connected to said feed dog member, and an eccentric device pivotally connected to said crank for rocking the same about its axis, the connection between said crank and said eccentric being adjustable with respect to the axis of said crank.

16. In a sewing machine, a feed plate and a presser foot adapted to guide material to be sewed, and feeding mechanism comprising a feed dog member mounted on an axis parallel to the direction of movement of the material being sewed, a vertically reciprocating member adapted to rock said feed dog member about said axis, a crank pivotally mounted on an axis perpendicular to the plane of said feed plate and pivotally connected to said feed dog member, said crank having a slot located therein, a pin adjustably positioned in said slot, and an eccentric device pivotally connected to said pin for rocking said crank about its axis.

17. In a sewing machine having a feed plate and a presser foot adapted to guide material to be sewed through the machine, a driven shaft, an eccentric mounted on said shaft, a member adapted to be reciprocated by said eccentric in a plane parallel to the plane of said feed plate, a second eccentric mounted on said shaft, a feed dog member adapted to be reciprocated along an axis parallel to the plane of said feed plate by said second eccentric, and a link pivotally connected at its

ends to said reciprocated member and said feed dog member, respectively, whereby a portion of the feed dog member is caused to travel through a substantially two-dimensional path, a portion of which extends past said feed plate.

18. In a sewing machine, a feed-dog movable substantially in a plane at right angles to the plane of the material being sewed, means for giving said feed-dog a component of motion perpendicular to the plane of the material including a universally pivoted link attached to said feed-dog at one end and means to reciprocate the opposite end of said link angularly thereto, and means including a lever for giving said feed-dog a component of motion parallel to the plane of said material simultaneously with the first component of motion whereby said feed-dog moves in a curved path, and means for varying the leverage ratio of said lever whereby the path of said feed-dog may be varied.

19. In a sewing machine, a member having an orbital movement imparted thereto, a pivoted arm carrying said member, means to cause reciprocation of said arm along its pivotal axis, a block reciprocating at an angle to said axis and in a plane removed therefrom, and a link between said arm and block resolving their reciprocatory movements into orbital movement of said member.

20. In a sewing machine, a feed plate and a presser foot between which material to be sewed may be passed, a feed-dog operable through said feed plate to cause movement of the material through the sewing machine, a pivoted arm carrying said feed dog, means to cause reciprocation of said arm along its pivotal axis, a block reciprocating at an angle to said axis and in a plane removed therefrom, and a universally pivoted link extended between, and attached to, said arm and said block at its ends and resolving the reciprocatory movements of said arm and said block into orbital movement of said feed-dog.

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