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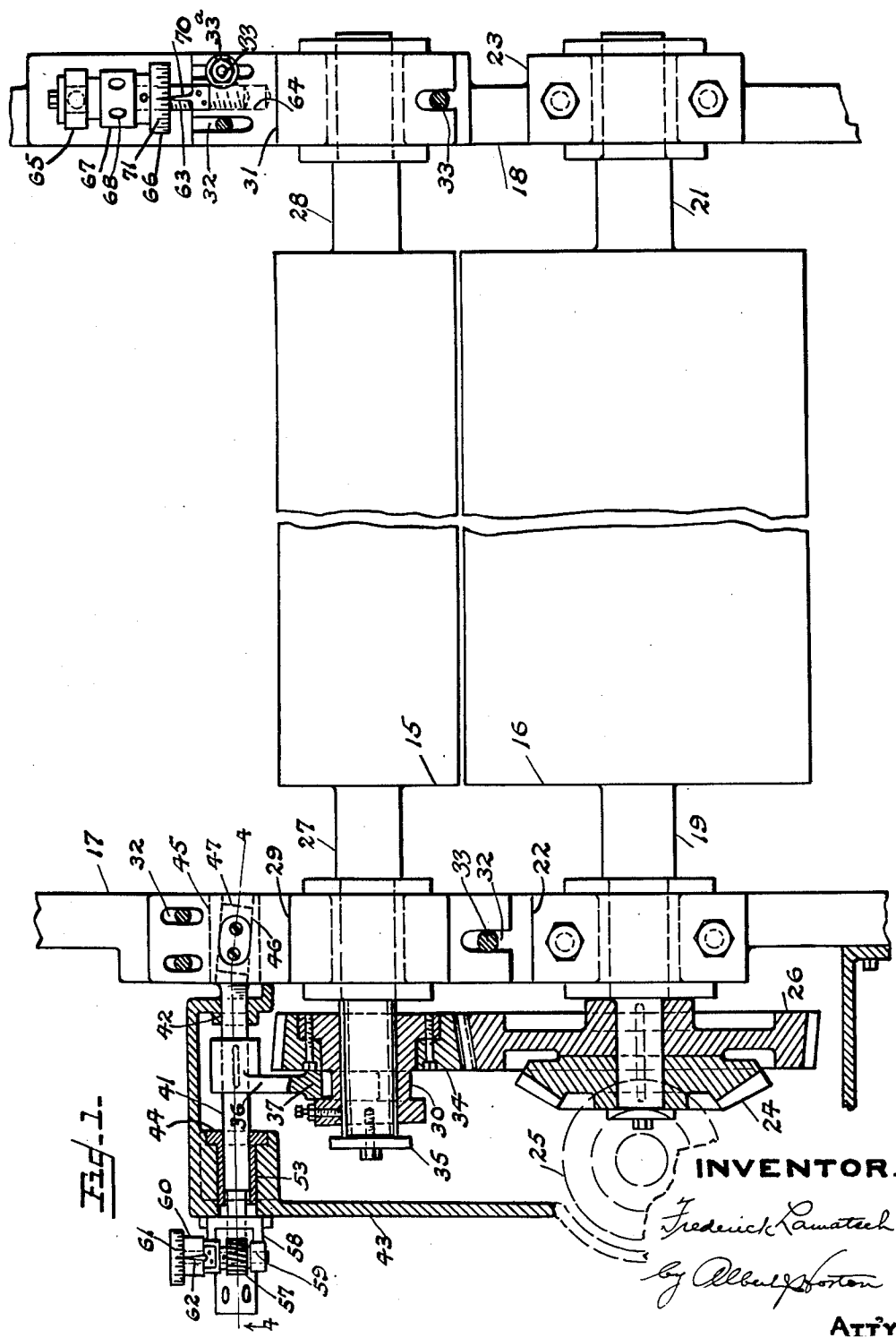
F. LAMATSCH

2,028,786

GEARING FOR ROTARY PRINTING MACHINE FOLDERS

Filed April 28, 1934

3 Sheets-Sheet 1



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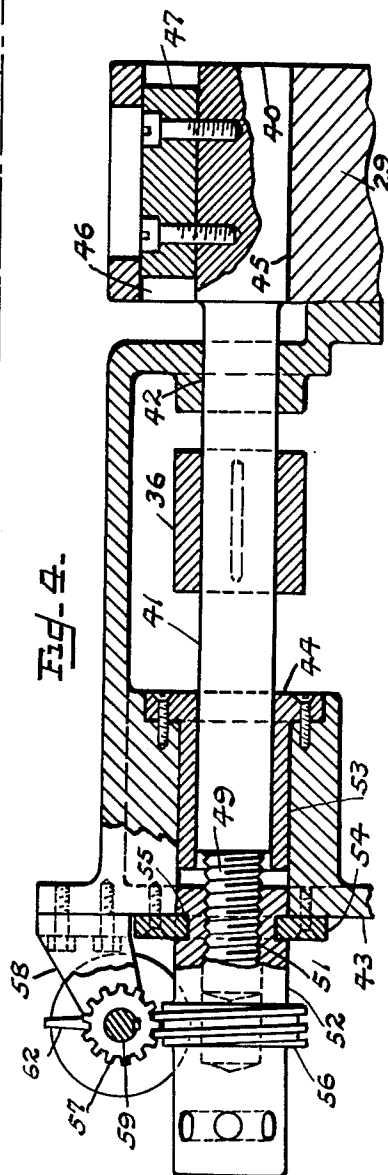
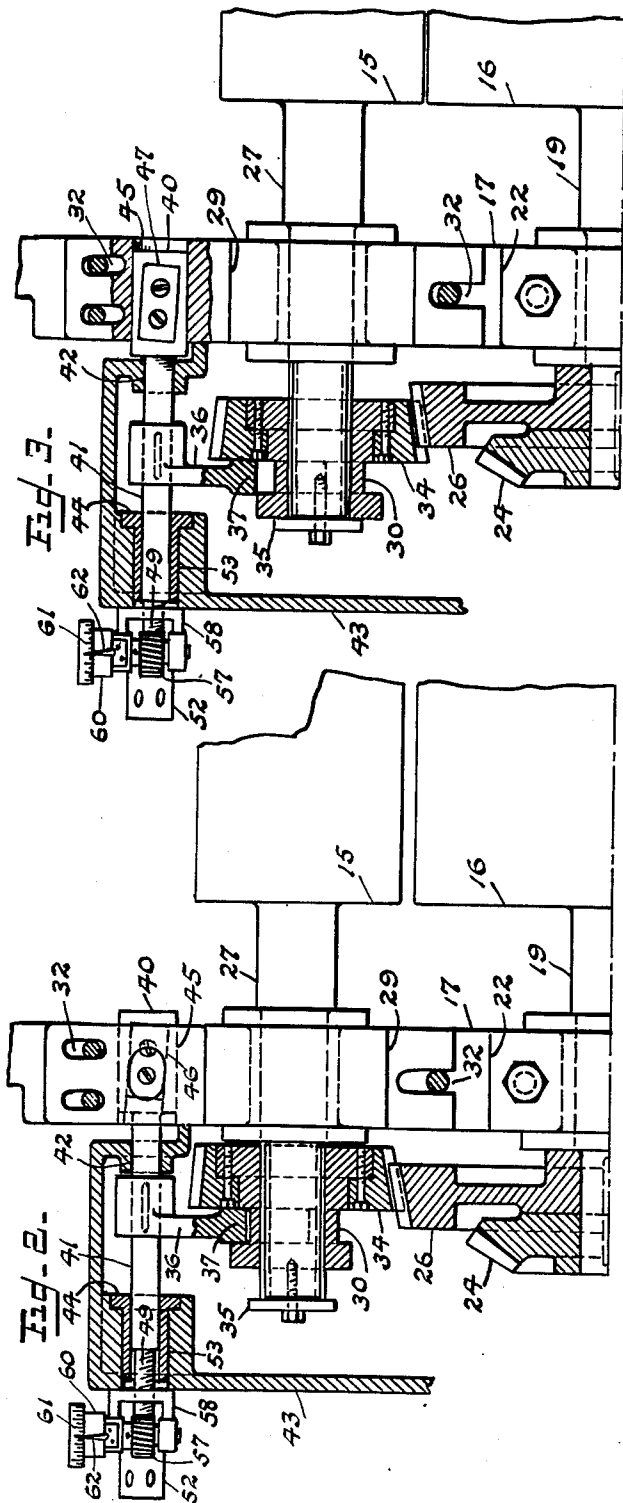
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GEARING FOR ROTARY PRINTING MACHINE FOLDERS

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 6.

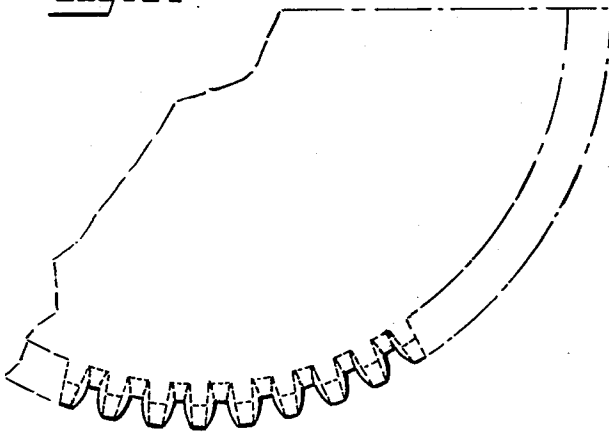


Fig. 9.

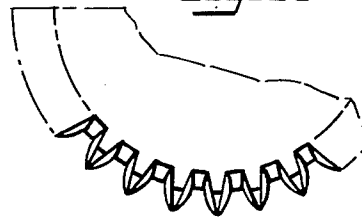


Fig. 5.

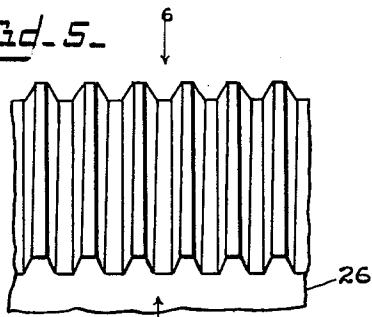


Fig. 8.

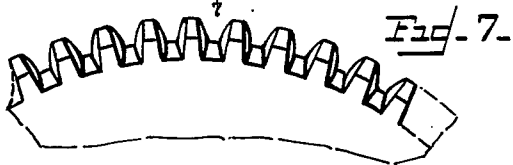
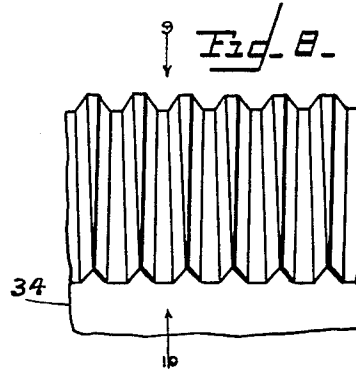


Fig. 7.

Fig. 10.

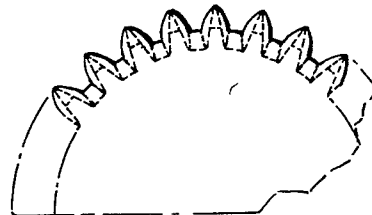
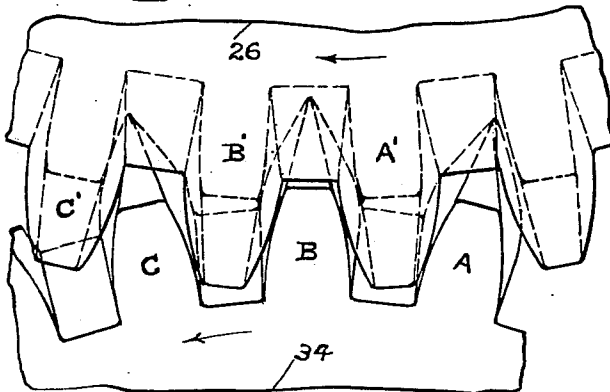


Fig. 11.



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UNITED STATES PATENT OFFICE

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GEARING FOR ROTARY PRINTING
MACHINE FOLDERS

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18 Claims. (Cl. 74—397)

This invention relates to a novel form of gear structure in a drive applied to a pair of parallel rotatable members to rotate same, and a mechanism for varying the distance between the axes of the rotatable members and gears, without altering the amount of clearance between the sides of the teeth of the driving and driven gears. The mechanism is particularly applicable for use with cutting and folding cylinders of a printing machine, where it is necessary to cut and fold products of varying thickness.

It is one object of this invention to provide a means whereby the axial spacing between a pair of parallel cylinders or like members may be adjusted without altering the true driving relation between a pair of gears which are connected to said cylinders and are in direct meshed relation.

It is a further object to provide an improved form of gear having a tapered toothed face, which, when meshed with a similar gear, is adapted to be moved to either side of the latter gear when an increase or decrease in distance between their axes is made, without altering their true driving relation.

Another object is to provide a mounting for two parallel cylinders, one of which cylinders is adapted to be adjusted toward or away from the other, and to also provide means to adjust the position of one of a pair of driving gears secured thereto, in an angular sideward direction, to alter the distance between their axial centers.

A still further object is to provide a calibrated adjustment for each end bearing of a cylinder which is mounted in parallel axial alignment with another cylinder, one of said adjustments being also adapted to alter the sidewise position of one of a pair of driving gears which are directly attached to the cylinders.

With the foregoing and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts, and in the details of construction hereinafter described and claimed.

Briefly stated, the device comprises an adjusting mechanism for two cylinders which have their spindles mounted in two side frame members. One of said cylinders is rotated preferably on a fixed center and is driven from some portion of the general machine drive. The other cylinder is mounted in adjustable bearing members and has a driven pinion gear thereon which is geared in direct driving relation with a driving gear on the first named cylinder. Said gear and pinion have tapered faces and specially generated teeth thereon which will permit an adjustment to be

made to increase or decrease the distance between their axes and still maintain the normal clearance or backlash of the gears.

The adjustable cylinder has an adjustment means for adjusting the position of a bearing on one end thereof, which includes a horizontally movable bar having a cam actuating portion which is adapted to engage a cam groove in the bearing to adjust said bearing when the bar is moved, and also has a forked member secured thereto, which is adapted to shift the pinion sideward at the same time the bearing is adjusted. When the pinion is moved sideward toward the frame, the cylinder will be moved outward simultaneously therewith, to increase the distance between the cylinder axes, which movement will cause the pinion to move in an angular direction to follow the tapered face of the gear, and by means of the specially formed teeth thereon, will remain in normal running relation with the gear. A similar movement of the horizontally movable bar in the opposite direction will cause the cylinder to be moved inward to decrease the distance between their axes. Another adjustment member is applied directly to the adjustable bearing at the opposite end of the adjustable cylinder and a calibrated collar is provided for each of the adjustment members. When the readings on each of said calibrated collars are in agreement, the cylinders are in parallel alignment.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a plan view with parts in section and parts broken away, showing two cylinders mounted in parallel relation, adjustable members to vary the distance between said cylinders, and driving gears for the cylinders;

Figure 2 is a fragmentary plan detail view of the driving gears and a portion of the cylinders adjusted to a position in which the space between the cylinders is increased;

Figure 3 is a view similar to Figure 2, showing the cylinders adjusted to a position in which the space between them is less than shown in Figure 1, and showing the driving gears in their relative adjusted position;

Figure 4 is a vertical sectional view taken on the line 4 of Figure 1, with parts broken away and parts in elevation, showing an adjustment member which controls the position of the pinion gear, and one end bearing for the adjustable cylinder;

Figure 5 is a fragmentary view of the driving gear showing several gear teeth in plan;

Figure 6 is a fragmentary detail view looking in the direction of the arrows 6 of Figure 5, and showing the shape of the gear teeth from the large diameter of the gear;

5 Figure 7 is a fragmentary detail view looking in the direction of the arrow 7 of Figure 5, and showing the shape of the gear teeth from the small diameter of the gear;

10 Figure 8 is a fragmentary view, similar to Figure 5, of the pinion gear;

Figure 9 is a fragmentary detail view looking in the direction of the arrow 9 of Figure 8, and showing the shape of the gear teeth from the small diameter of the pinion gear;

15 Figure 10 is a fragmentary detail view looking in the direction of the arrow 10 of Figure 8, and showing the shape of the gear teeth from the large diameter of the pinion gear; and

20 Figure 11 is an enlarged fragmentary detail view showing a portion of the gear and pinion in meshed relation as seen from the large diameter of the gear and the small diameter of the pinion.

Referring to Figure 1, two cylinders 15 and 16 are mounted in parallel spaced relation between 25 two side frames 17 and 18 of the machine. The cylinder 16 has spindles 19 and 21 extending therefrom and supported in bearings 22 and 23 respectively, which bearings are secured in a fixed position to the side frames 17 and 18. A bevel gear 24 is fixed to a reduced end of the spindle 19 and is adapted to be driven by a pinion indicated at 25, which is connected with the machine drive mechanism. Another gear 26 is also 30 fixed to the spindle 19 as shown in Figure 1.

35 The driven cylinder 15 has spindles 27 and 28 extending therefrom, which are supported in bearings 29 and 31, and the bearings are adjustably mounted upon the frames 17 and 18 by means of the stud and slot connections indicated at 32 and 33 respectively. After an adjustment is made, the bearings are clamped by means of 40 nuts on said studs indicated at 33^a. A pinion 34, which meshes with the gear 26, is secured to a sleeve 30 and said sleeve is keyed to the spindle 27 in such manner as to cause the pinion to rotate with the spindle but to be movable endwise thereof. An abutment plate 35 is secured 45 to the end of the spindle 27 and extends into the path of the pinion sleeve 30.

50 Said pinion sleeve 30 is adapted to be moved along the spindle 27, by means of the forked end 37 of an arm 36, which arm is fixed to a horizontally slidable bar 41. The said bar 41 is slidable within a bearing 42 and a bushing 44, 55 mounted within a gear housing 43, supported by the side frame 17. As best shown in Figure 4, the inner end of said bar is in the form of a rectangular block 40, which is slidable within an opening 45 in the adjustable bearing 29. A pad 47 is secured to the upper surface of the block 60 portion 40 in an angular relation and extends into an angularly disposed cam slot 46, in the adjustable bearing.

65 The opposite end 49 of said bar 41 is screw threaded and is in engagement with a screw threaded opening 51 in a nut 52. Said nut is rotatably mounted within an opening 53 in the gear housing 43 and is prevented from moving 70 endwise by means of a collar 54, which is secured to the outer wall of the gear housing and engages an annular groove 55 in the nut. A worm 56 is also provided on said nut and meshes with a worm gear 57. Said worm gear is fixed to a 75 shaft 59 and the shaft is supported by means of

a bracket 58, secured to the gear housing 43. A collar 60 having calibrations 61 thereon, is fixed on one end of the shaft 59 and is adapted to be rotated therewith, and the calibrated portion is adapted to move beneath a pointer 62 fixed on 5 the bracket 58.

The nut 52 may be rotated in any convenient manner by a wrench or other tool and when rotated will cause the bar 41 to be moved inward or outward, whereupon the movement of the pad 10 47 through the angular slot 46 will move the bearing 29 to adjust same. The forked arm 36 will also move with the bar 41 and will slide the pinion 34 with it.

It will be observed that both the driving gear 15 26 and the pinion 34, which meshes therewith, have tapered faces and that the taper is substantially the same as the angle of the angular groove 46 in the adjustable bearing 29. The reason for this structure is to provide a means whereby the teeth of the gear 26 and pinion 34 will remain in their normal operating mesh regardless of the fact that the distance between their gear centers will be increased or decreased. With 20 such a condition it is therefore possible to eliminate an increased clearance or backlash which would ordinarily result when an adjustment would be made to increase the distance between the centers of two meshed gears.

The gear teeth on both the gear and pinion are 30 of involute tooth formation, but the thickness and general profile of the teeth will vary throughout their length, which condition is particularly emphasized in regard to the pinion teeth as will be noted from Figures 8 to 11 of the drawings. 35

Gears of this type have been generated on a hobbing machine that is regularly employed for cutting spur and helical gears, and is also adapted for hobbing worm wheels. When used to generate these taper face gears, the machine is so 40 arranged that during the cutting operation, the gear blank is moved simultaneously toward or from the hob, as may be necessary, while the hob is moving along the face of the gear. It will be understood that by this method of cutting, a tooth form can be produced that may be considered as 45 normal at some plane through the gear, but the tooth form is extended considerably above normal at one side of the gear face and undercut below normal at the other side of the gear face. It will be further understood that inasmuch as an involute tooth form is employed, that the meshing action of gears thus cut will be theoretically correct over their extended and undercut ranges. 50

Owing to the fact that the thickness of the teeth 55 of these gears vary, the angle formed by the slot 46 in the pillow block 29, with respect to the cylinder axes, is slightly less than the angle formed by the periphery of the teeth with respect to the said axis, this difference varying in dependence 60 on the taper of the gear faces.

The gears are, to a certain extent, helical gears, with a different hand of helix on opposite sides of the teeth and when in mesh, the active faces of the meshed teeth may be in contact anywhere 65 along each meshed tooth face, and these lines of contact will move across the teeth as the gears rotate, in the same manner as is the case with regular helical gears. In Figure 11, the above condition can be followed, through the three positions of the teeth shown. Here the near end of the forward face of the tooth A is shown engaging the near end of the rear face of the tooth A', while at the far end of the rear face of the tooth A', no contact has yet been made. Teeth B and 75

B' show their active faces in mesh at about the central portion at the near ends thereof, while at their far ends, the tooth B is shown as just about to engage the tooth B'. The near face of tooth C is just moving out of active contact with the face of the tooth C', while the far end of the tooth faces C and C' are still in contact.

The meshed teeth are always in contact along some portion of their active tooth faces, regardless of whether the sides of one gear are in alignment with the sides of the other gear or are in an offset relation. Because of the tapered formation of the gears, it is possible to shift one of said gears side-ward or beyond either side of the other and along the tapered face thereof within the limits of the adjustment provided, without altering the normal running relation of the gears. With this arrangement, there will always be a true conjugate gear tooth action throughout the adjustment range.

While the foregoing is related particularly to the adjustment of the driving end of the rollers 15, the opposite end must also be adjusted a corresponding amount. To make an adjustment on the latter, a shaft 63 is provided with a screw portion which screws into a threaded opening 64 in the adjustable bearing 31, and is rotatably mounted in a bearing block 65 fixed to the frame 18, but is prevented from having any endwise movement within said bearing block. A calibrated collar 66 is secured to the shaft 63 and a head 67 is provided with openings 68, for a pin or wrench to be inserted therein, to rotate said shaft. A pointer 70 is fixed to the slidable bearing 31 and is positioned over the calibrated portion 71 of the collar. Each of said dials 61 and 66 have their calibrations arranged so that they will agree when the cylinders 15 and 16 are in a parallel spaced relation, and further, will provide a guide for the attendant when an adjustment is to be made, when a certain predetermined space is required between the cylinders.

In Figure 1, the cylinders are shown spaced apart, and the gear 19 and pinion 34 are shown in vertical alignment, which position can be assumed as a normal running position of the cylinders. When, however, it becomes necessary to change the distance between the cylinders, the nuts 52 will be rotated to move the bar 41 inward or outward and thus increase or decrease the distance between the cylinders accordingly, such as shown in Figures 2 and 3 respectively. As the bar moves inward to the position shown in Figure 2, it moves the pad portion 47 through the angular slot 46 in the adjustable bearing, which causes the cylinder 15 to be moved away from the cylinder 16. At the same time, the pinion 34 is moved along its shaft, which combination of movements results in moving it at the angle of the slot in the pillow block, which is the proper angle to maintain correct driving relation. Therefore, even though the distance between the axes of the cylinders 15 and 16 is increased, the gear and pinion will remain in normal driving relation.

When an adjustment is made to bring the rolls closer together, as in Figure 3, the bar 41 is moved outward and thereby moves the pinion outward, while the movement of the pad 47 through the slot 46 moves the cylinder 15 toward the cylinder 16. The opposite adjustable bearing 31 will be individually adjusted by rotating the screw shaft 63, and when both calibrated collars 60 and 66 have the same desired reading, the bearings will be secured in place by tightening the nuts 33^a.

It will be understood that the invention may be embodied in other specific forms, without de-

parting from the spirit or essential attributes thereof and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the claims rather than to the foregoing description.

What I claim is:

1. In a machine having two rotatable members supported with their axes in parallelism, a driving gear connected to one of said members, a driven gear meshing with the driving gear and connected to the other member, means for adjusting the spacing between the axes of the rotatable members, and means for further adjusting the position of one of said gears to compensate for said axes spacing adjustment and thereby maintain a normal meshing relation between said gears.

2. In a machine having two members rotatably supported with their axes in parallelism, one of said members having a fixed axis and the other member having a movable axis, a gear connected to one end of each of said members and positioned in direct meshing relation with each other, means for adjusting the spacing between the axes of the members, and means for further adjusting the position of one of said gears to compensate for the said axes spacing adjustment and thereby maintain a normal driving relation between the said meshed gears.

3. In a machine having two members rotatably supported with their axes in parallelism, a gear connected to one end of each of said members, each gear having a large diameter side and a small diameter side and being in a meshed driving relation with the other gear and with the large diameter side of one gear opposite the small diameter side of the other gear, means for adjusting the spacing between the axes of the said members, and means for further adjusting the position of one of said gears to compensate for the said spacing adjustment and thereby maintain a normal driving relation between the said meshed gears.

4. In a machine having two members rotatably supported with their axes in parallelism, a driving gear in axial alignment with one of the members and connected thereto, a driven gear in axial alignment with the other member and connected thereto, each of said gears having a tapered peripheral surface and being in a meshed driving relation with the other gear, means for adjusting the axial spacing between said members, and means to further adjust one of said gears, whereby backlash between the driving and the driven gears may be maintained constant regardless of the adjustment of the said members.

5. In a machine having two members rotatably supported with their axes in parallelism, fixed bearings for one of said members and adjustable bearings for the other member, a driving gear in axial alignment with one of the members and connected thereto, a driven gear in axial alignment with the other member and connected thereto, means for adjusting the position of said adjustable bearings to adjust the spacing between the axes of said members, and means for further adjusting the axial position of one of said gears, whereby backlash between the driving and the driven gears may be maintained constant regardless of the adjustment of the said members.

6. In a machine having two members rotatably supported with their axes in parallelism, fixed bearings for one of said members and adjustable

bearings for the other member, means for adjusting the position of said adjustable bearings to adjust the spacing between the axes of said members, a gear connected to each member, each gear having a conical form and being positioned with the large side of one gear opposite the small side of the other, and means to adjust the position of one of said gears when adjusting the spacing between the said members to maintain the gears continuously in normal driving relation.

7. In a machine having two members rotatably supported with their axes in parallelism, a gear for each of said members in meshed driving relation, each gear having a tapered toothed engaging surface, means for adjusting the spacing between the axes of the members, and means to adjust one of said gears in an angular direction along the tapered surface of the other gear to compensate for the member adjustment, whereby backlash between the meshed gears may be maintained constant regardless of the member adjustment.

8. In a machine having two members rotatably supported with their axes in parallelism, a driving gear in axial alignment with one of the members and connected thereto, a driven gear in axial alignment with the other member and connected thereto, each gear having a tapered toothed engaging surface and being in a meshed relation with the other gear, means for adjusting the axial spacing between the members, and means to simultaneously move one of said gears sideward when the adjustment is made, to thereby provide an angular movement of the movable gear over the tapered surface of the other gear and thus maintain said gears continuously in normal driving relation.

9. In a machine having two members rotatably supported with their axes in parallelism, a driving gear in axial alignment with one of the members and connected thereto, a driven gear in axial alignment with the other member and connected thereto, each gear having a tapered toothed engaging surface and the teeth of one gear are slidable through the spaces between the meshing gear teeth, means for adjusting the spacing between the axes of the members, and means to simultaneously move one of said gears sideward when the spacing between the said members is adjusted, to thereby provide an angular movement of the teeth of the movable gear through the tooth spaces of the other gear, while maintaining a normal meshing relation.

10. In a machine having two members rotatably supported with their axes in parallelism, adjustable bearings for one of said members, a driving gear and a driven gear connected to said members and meshed with each other, each gear having a tapered peripheral surface, means for moving said adjustable bearings to adjust the spacing between the axes of the members, and means for moving one of the gears sideward when the adjustable bearings are moved to compensate for the adjusted spacing of the said members and to maintain a constant amount of backlash between the driven and the driving gear.

11. In a machine having two members rotatably supported with their axes in parallelism, adjustable bearings for one of said members, screw actuated mechanism to adjust each adjustable bearing and to thereby adjust the spacing between the axes of the members, a driving gear

and a driven gear connected to said members, and positioned in a meshed driving relation with each other, each gear having a tapered peripheral surface to permit angular sideward movement thereof, and means for moving one of said gears sideward when the adjustable bearings are moved, whereby the amount of backlash between the driven and the driving gear may be maintained constant.

12. In a machine having two members rotatably supported with their axes in parallelism, an adjustable bearing for each end of one of said members, a screw actuated mechanism to adjust each adjustable bearing and to thereby adjust the axial spacing between the members, a calibrated device associated with each screw actuated mechanism, a driving gear and a driven gear connected to said members and positioned in a meshed driving relation with each other, each gear having a tapered toothed surface to permit angular sideward movement thereof, and means for moving one of said gears sideward when the adjustable bearings are moved to thereby maintain normal driving relation between said gears.

13. In a gear mounting, a driving gear and a driven gear in meshed position therewith, a tapered periphery on each of said gears and having involute teeth cut therein, and means to move one of said gears angularly sideward to follow the angle of the beveled peripheral surface of the other gear, to thereby adjust the spacing between the axes of the two gears and still maintain a normal meshed relation between them.

14. A pair of gears each having a tapered periphery and involute teeth thereon and adapted to mesh in normal running relation, and movable means for supporting one of said gears, whereby they are maintained either with their end faces in alignment or in an offset relation.

15. A gear drive comprising two gears in meshed driving relation, each gear having a coned peripheral surface with involute teeth cut therein, and movable means for supporting one of said gears, whereby it is movable angularly sideward in relation to the other gear without altering the normal conjugate gear tooth action.

16. A gear drive comprising two gears in meshed driving relation, each gear having a tapered toothed engaging face and having teeth which are slidable through the spaces between the meshing teeth, and movable means adapted to support one of said gears in a manner which will permit it to be maintained in constant normal driving relation with the other gear when said first named gear is moved sideward in relation to the other.

17. A gear drive comprising two gears, each having a large diameter side and a small diameter side and positioned in meshing relation with the small diameter side of one gear opposite the large diameter side of the other gear, the teeth of one of said gears being longitudinally slidable between the teeth of the other gear in either direction without varying the meshing relation thereof.

18. A pair of coacting gears, each having teeth adapted to mesh with teeth of the other gear selectively at any one of a plurality of pitch diameters and to maintain the same amount of backlash at each pitch diameter.