

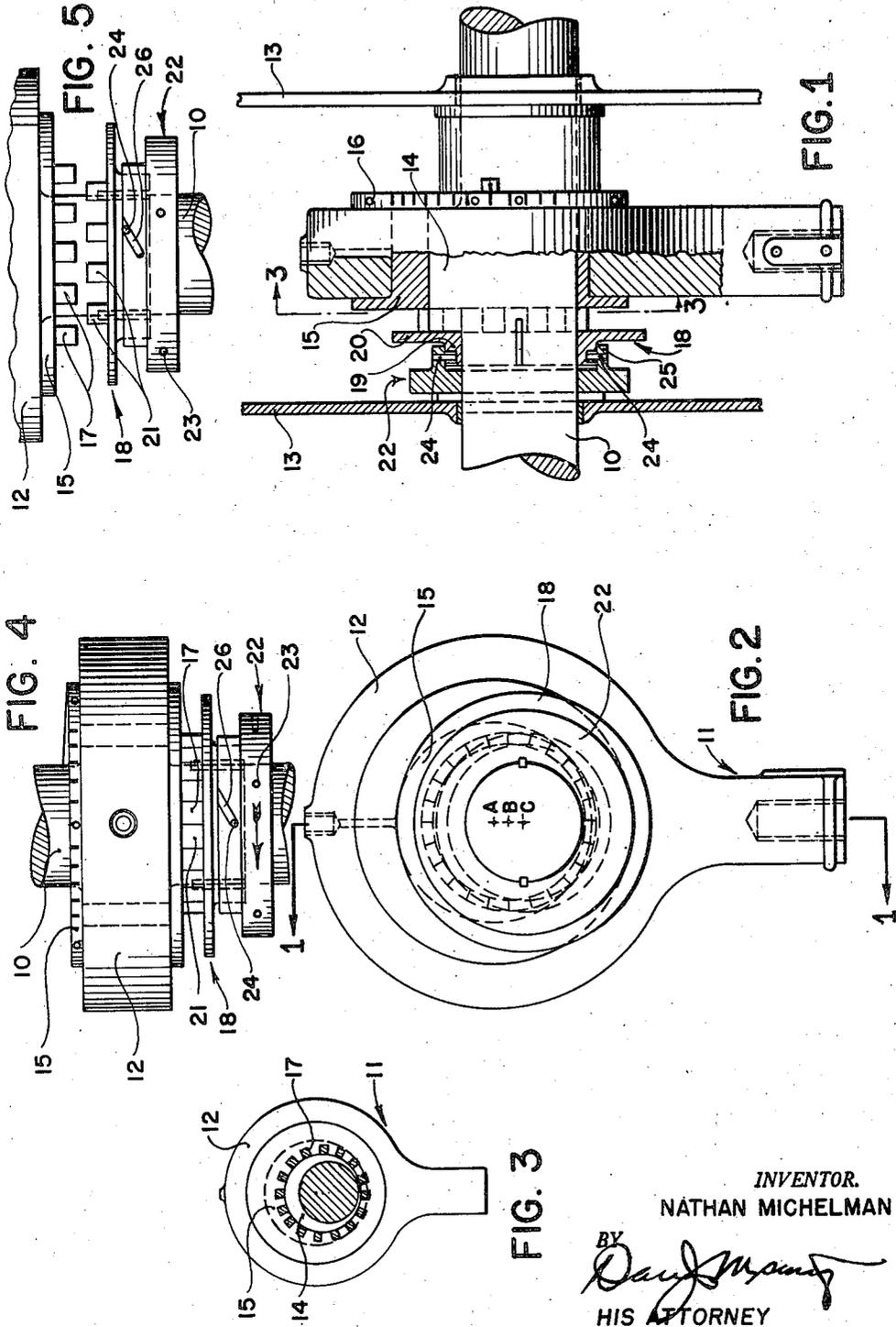
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ADJUSTABLE STROKE ECCENTRIC MECHANISM

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ADJUSTABLE STROKE ECCENTRIC MECHANISM

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This invention relates to an adjustable stroke eccentric mechanism for actuating reciprocating element or slide in a machine such as a press or the like. While reference is made herein particularly to presses wherein the stresses in the slide actuating mechanism are particularly high, it is to be understood that my invention can be applied to any other mechanism in which it may be desirable to vary the length of stroke of a reciprocating element.

According to my invention power is transmitted from a driving shaft to a slide through a connecting rod and a combination of eccentrics, said eccentrics having a free or slidable engagement with one another to vary their angular relationship, the outer one of said eccentrics being driven from said driving shaft through the interposition of suitable disengageable coupling means. As long as said coupling means are engaged, the combination of eccentrics behave as a single eccentric of a certain eccentricity. When said coupling means are disengaged, the angular relationship of the eccentrics can be manually varied to change the total eccentricity of the combination practically to any desired value comprised between zero and a maximum. Suitable scale means are preferably provided to indicate the total eccentricity.

It is the general purpose of my invention to provide an adjustable stroke eccentric mechanism for use in presses or the like, which mechanism may be set for practically any length of stroke between zero and the maximum.

A more specific object is to provide a mechanism of the character described, wherein the length of stroke may be set to the desired value in a single operation and without disassembling any part of the mechanism.

Another object is to provide a mechanism of the character described, wherein the length of stroke may be adjusted to a very fine degree, and wherein the available lengths of stroke are so close to each other that the adjustment is practically continuous and can be made truly continuous, if so desired.

A further object is to provide a mechanism achieving the previous object with an extreme simplicity and the ruggedness of structure and a minimum of component parts.

A still further object is to provide a mechanism of the character described, wherein the length of stroke may be adjusted in a single manual operation requiring the shortest time and needing no special skill on the operator's part.

A still further object is to provide a mecha-

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nism achieving any and all of the aforementioned objects, which mechanism is efficient, simple and economical to manufacture.

Other related and ancillary objects of my invention will clearly appear as the description proceeds.

In the drawings:

Fig. 1 is a side view and part longitudinal section of a mechanism according to my invention.

Fig. 2 is a cross-section of Fig. 1 taken along the line 2—2 looking in the direction of the arrows, particularly showing the centers of the various component elements of the mechanism.

Fig. 3 is a cross section of Fig. 1 taken along the line 3—3, looking in the direction of the arrows.

Fig. 4 is a plan view of the mechanism of Fig. 1.

Fig. 5 is a plan view of a detail of the same mechanism shown in an inoperative or disengaged position.

Referring now in detail to the drawing, 10 designates a driving shaft, and 11 designates a connecting rod, of which only part is shown, which connecting rod is coupled to the slide, also not shown, and embodies an eccentric strap 12. 13 are plates or in general stationary elements forming part of the frame of the press or like machine of which this mechanism is a part, in which frame the shaft 10 is supported.

An inner eccentric 14 is fast on the shaft 10 and may be solid therewith or rigidly connected thereto. Freely mounted on the inner eccentric 14 is an outer eccentric 15, which latter is provided with means for rotating it with respect to the inner eccentric. In the particular embodiment shown, these means comprise holes 16 in the periphery of the eccentric 15, in which holes 16 there can be inserted a rod or key whereby the eccentric 15 can be turned. However, any number of substantially equivalent mechanical means could be devised to substitute for the holes 16 and the corresponding key. On one end of the eccentric 15 there are formed or attached a number of longitudinally projecting teeth indicated at 17. These teeth are disposed on a circle concentric with the inner eccentric 14, so that no matter what the angular position of the outer eccentric 15 may be, said circle remains parallel to the periphery of said inner eccentric 14.

Keyed to the shaft 10 there is a member 18 which in the embodiment illustrated, comprises a hub portion 19, a disc portion 20 and a set of teeth 21. These teeth 21 are matable to the teeth 17, and

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therefore are also disposed on a circle concentric with the inner eccentric 14. The member 18 is slidable longitudinally along the shaft 10, while still remaining in driving engagement therewith. A member 22 is free on the shaft 10, and carries on the periphery thereof of holes 23, similar to and having the same purpose as the holes 16 of the eccentric 15, and for which a key is provided. As in the case of the holes 16, suitable actuating means could be substituted for the holes 23 and the corresponding key. The member 22 has a number of pins 24, in the embodiment illustrated two of them, radially projecting internally of a sleeve portion 25 of the member 22, which sleeve portion surrounds the hub portion 19 of the member 18. Said pins 24 engage a corresponding number of cam slots 26 in the hub portion 19. Said cam slots 26 extend at an angle to the axis of the shaft 10, so that if the member 22 is rotated about the shaft 10, the member 18 which cannot so rotate is forced to move axially with respect to said shaft.

When the member 18 is all the way to the right, as viewed in Fig. 1, the teeth 17 and the teeth 21 are in engagement. The member 18 rotates with the shaft 10, inasmuch as it is keyed thereto. Therefore the outer eccentric 15 must also rotate with the shaft 10 and with the inner eccentric 14 which is fast to this latter. The direction of the cam slots 26 is so related to the direction of rotation of the shaft 10 that the effect of said rotation is to urge the member 18 to the right. Thus in operation there is no possibility that the teeth 17 and 21 will become disengaged. Now if the member 22 is manually rotated in a direction to force the member 18 to the left as viewed in Fig. 1 (the direction indicated by the arrow in Fig. 4), said teeth 17 and 21 become disengaged the ones from the others. Now the outer eccentric 15 is free to rotate between the inner eccentric 14 and the eccentric 14 and the eccentric strap 12. As it rotates, the total eccentricity of the mechanism varies. It is desirable to have a scale marked on the periphery of the outer eccentric 15 and an index for such scale in invariable positioned relationship to the inner eccentric 14. Said scale preferably has indicated thereon the length of stroke corresponding to each angular position of the outer eccentric 15, so that the mechanism may be directly set by an operator to the desired length of stroke. When the outer eccentric 15 has been brought to the desired angular position, the member 22 is actuated in a direction opposite to the arrow of Fig. 4, the member 18 is urged all the way to the right, the teeth 17 and 21 become once more engaged, and the outer eccentric 15 is once again in driving connection with the shaft 10. Obviously in the embodiment illustrated the angular position of the outer eccentric 15 must be one in which the teeth 17 and 21 can be engaged, that is the angular displacements that are possible must produce peripheral displacements of the teeth 17 equal to a multiple of the width of a tooth. This sets a lower limit for the smallest permissible angular adjustment of the outer eccentric 15. However, said lower limit is small enough for any practical application. Still, if so desired, a clutch arrangement different from the one illustrated, could be provided in order to lower said lower limit still further. It would even be possible to employ a clutch of any one of the types which can be engaged in any angular relationship. It is to be clearly understood that teeth 17 and 21 have been shown a preferred means for establishing a

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driving connection between the member 18 keyed to the shaft 10 and the outer eccentric 15 solely for the sake of illustration, and that a person skilled in the art could devise any number of mechanical equivalents thereof without departing from the invention.

Fig. 2 has indicated thereon at A, B and C respectively the centers of the outer eccentric 15, the inner eccentric 14 and the driving shaft 10. The eccentricity of the outer eccentric 15, which is also the total eccentricity of the mechanism is, by definition, the distance between the center A of the eccentric figure and the center C of rotation.

In this further embodiment of the segment AB is equal to the segment BC. In the arrangement of Fig. 2, wherein the points A, B and C are in a straight line, the length of stroke is maximum as the eccentricities of the two eccentrics are added to one another.

Indicating by r the length of segments AB or BC, if the outer eccentric is rotated by an angle a one way or the other from the position of Fig. 2, the total eccentricity — is equal to

$$2r \cdot \cos \frac{a}{2}$$

It is seen that the total eccentricity is equal to $2r$, a maximum, when $a=0$, and becomes zero when $a=180^\circ$, that is when the outer eccentric 15 has been rotated so that the center A coincides with the center C.

Any value of the stroke between zero and this maximum can be obtained by angular adjustments of the outer eccentric 15 in the manner hereinbefore described. If AB is not equal to BC, the relationship between angle a and total eccentricity is slightly more complex, but still easily obtainable by application of the law of sines.

While I have described a preferred embodiment of my invention by way of illustration, I want it understood that I am not to be limited to the details herein set forth, and that many modifications and adaptations may be made in the mechanism described by persons skilled in the art without departing from the spirit of the invention or exceeding the scope of the appended claims.

I claim:

1. In an adjustable stroke eccentric mechanism in combination with a reciprocating driver for a reciprocable member; a driving shaft, an inner eccentric fast on said shaft, an outer eccentric free on said inner eccentric, means for operatively connecting said outer eccentric to said driver for the reciprocable member, a member keyed to said driving shaft and actuatable between two extreme positions, means for coupling said keyed member to said outer eccentric to drive the latter, said coupling means being operative when said keyed member is in one extreme position and inoperative when said keyed member is in the other extreme position, a member free on said shaft, means for rotating said free member on said shaft, mutually engaging cam and follower means in said keyed member and free member for actuating said keyed member between said two extreme positions thereof in response to a rotation of said free member, and means for rotating said outer eccentric with respect to said inner eccentric when said coupling means are inoperative, whereby to vary the eccentricity of said outer eccentric with respect to said driving shaft and to adjust the stroke of the reciprocable member.
2. In an adjustable stroke eccentric mechanism

in combination with a reciprocating driver for a reciprocable member; a driving shaft, an outer eccentric free on said inner eccentric, means for operatively connecting said outer eccentric to said driver for the reciprocable member, a member keyed to said driving shaft and axially slidable between two extreme positions, means for coupling said keyed member to said outer eccentric to drive the latter when said keyed member is in one extreme position, said coupling means being inoperative when said keyed member is in the other extreme position, a member free on said shaft, means for rotating said free member, at least one follower pin fast to said free member, said keyed member having at least one slot engaged by said follower pin and disposed at an angle to the axis of said driving shaft, whereby rotation of said free member causes axial sliding of said keyed member between said extreme positions thereof, and means for rotating said outer eccentric with respect to said inner eccentric when said coupling means are inoperative, whereby to vary the eccentricity of said outer eccentric with respect to said driving shaft and to adjust the stroke of said reciprocable member.

3. In an adjustable stroke eccentric mechanism in combination with a reciprocating driver for a reciprocable member; a driving shaft, an inner eccentric fast on said shaft, an outer eccentric free on said inner eccentric, means for operatively connecting said outer eccentric to said driver for the reciprocable member, a member keyed to said driving shaft and actuatable between two extreme positions, means for coupling said keyed member to said outer eccentric to drive the latter, said coupling means being operative when said keyed member is in one extreme position, a member free on said shaft, hand-actuated means for rotating said free member on said shaft, mutually engaging cam and follower means in said keyed member and free member for actuating said keyed member between said two extreme positions thereof in response to a rotation of said free member, and hand-actuated means for rotating said outer eccentric with respect to said inner eccentric when said coupling means are inoperative, whereby to vary the eccentricity of said outer

eccentric with respect to said driving shaft and to adjust the stroke of the reciprocable member.

4. In an adjustable stroke eccentric mechanism, in combination with a reciprocating driver for a reciprocable member; a driving shaft, an outer eccentric free on said inner eccentric, means for operatively connecting said outer eccentric to said driver for the reciprocable member, a member keyed to said driving shaft and axially slidable between two extreme positions, a first set of teeth fast on said keyed member and disposed along a circle concentric with said inner eccentric, a second set of teeth fast on said outer eccentric and matable to said first set, said sets of teeth being in interlocking engagement with one another drivingly to connect said keyed member to said outer eccentric when said keyed member is in one extreme position and being disengaged when said keyed member is in the other extreme position, a member free on said driving shaft, means for rotating said free member, mutually engaging cam and follower means in said keyed member and free member for actuating said keyed member between said two extreme positions thereof in response to a rotation of said free member, and means for rotating said outer eccentric with respect to said inner eccentric when said sets of teeth are disengaged, whereby to vary the eccentricity of said outer eccentric with respect to said driving shaft and to adjust the stroke of the reciprocable member.

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