Jan. 24, 1928.

1,657,434

R. T. HAZELTON

CIRCULAR FEEDING ATTACHMENT

Filed Sept. 2. 1924

3 Sheets-Sheet 1

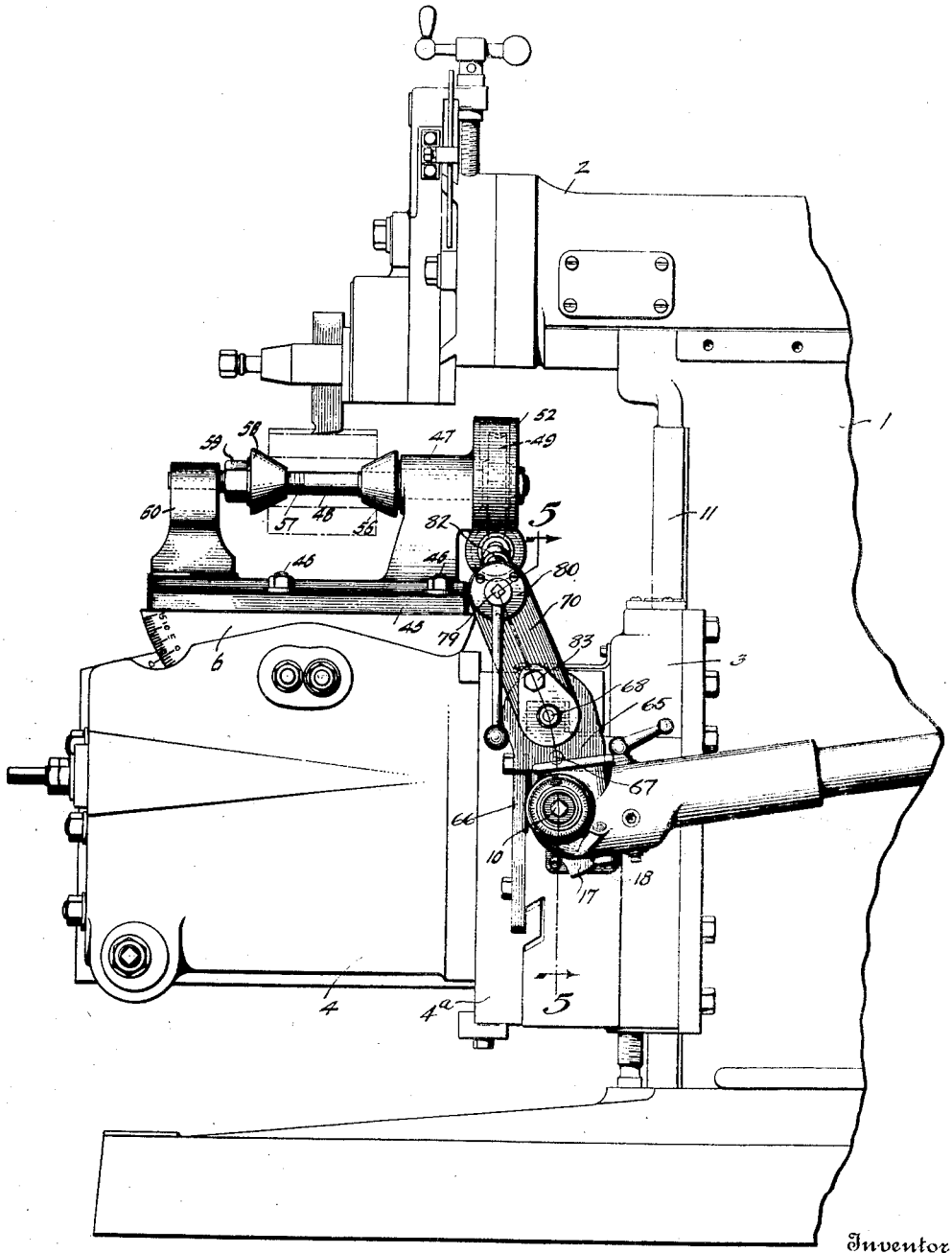

Fig. 1

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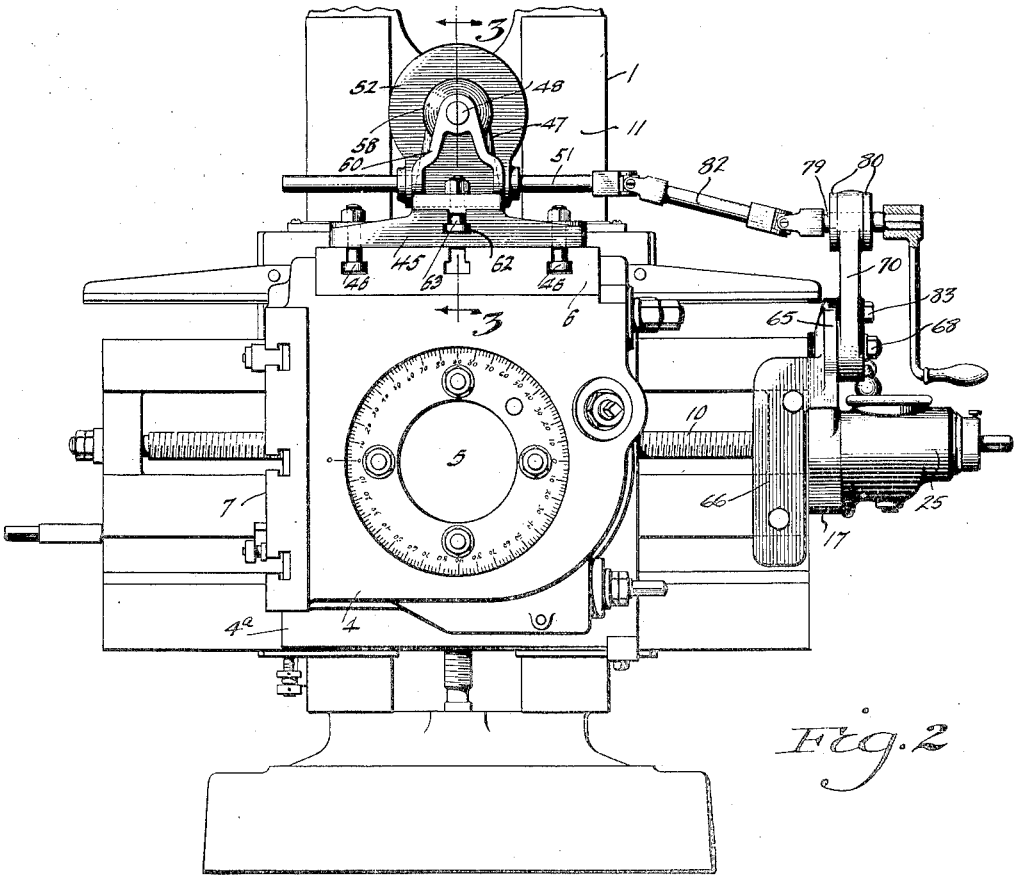

Fig. 2

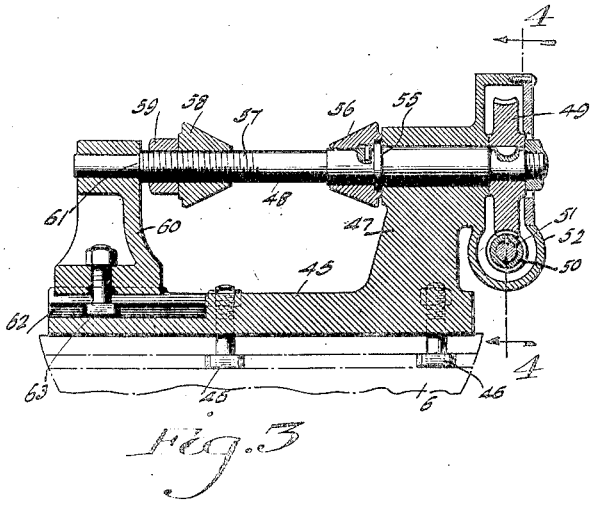

Fig. 3

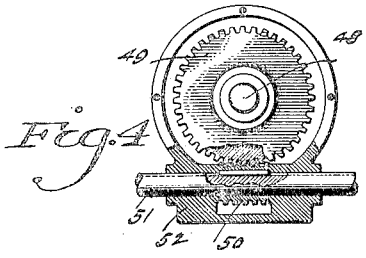

Fig. 4

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Fig. 8.

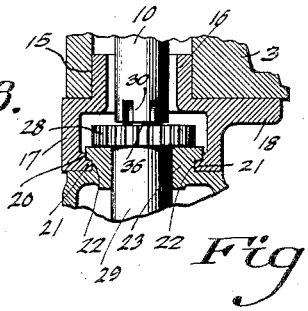


Fig. 9.

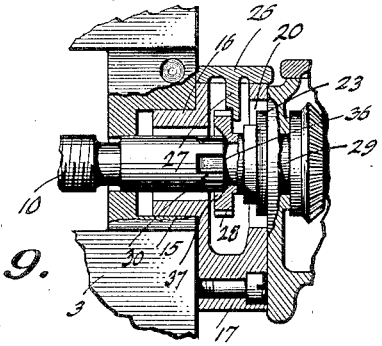


Fig. 7

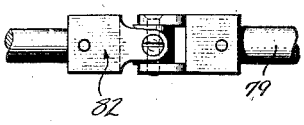


Fig. 6.

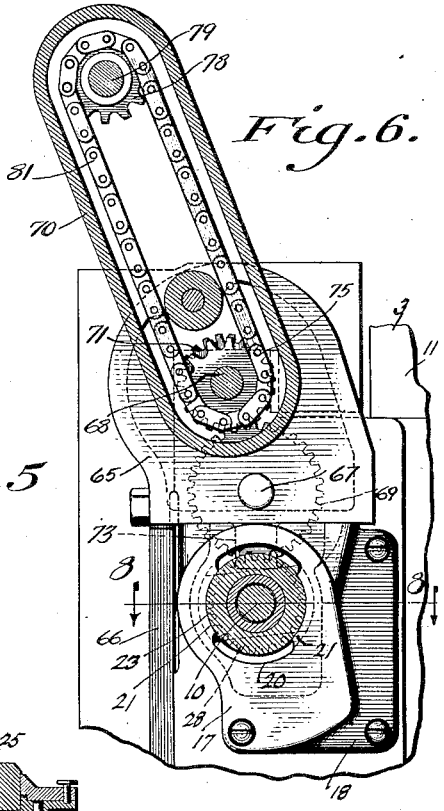
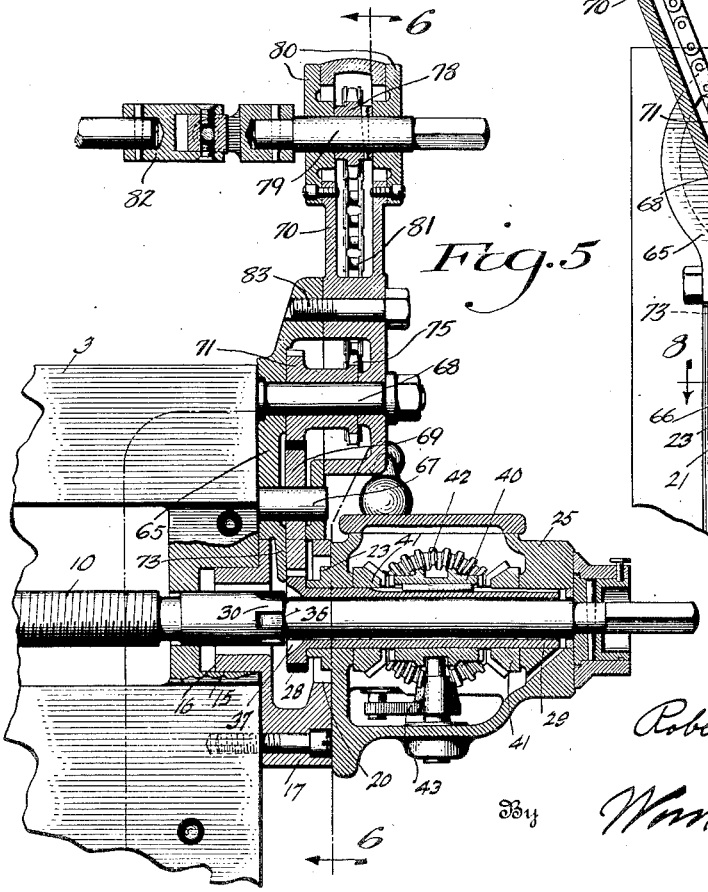


Fig. 5



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UNITED STATES PATENT OFFICE.

ROBERT T. HAZELTON, OF CINCINNATI, OHIO, ASSIGNOR TO THE CINCINNATI SHAPER COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

CIRCULAR-FEEDING ATTACHMENT.

Application filed September 2, 1924. Serial No. 735,245.

This invention relates to improvements in transmission mechanism for machine tools, particularly of the shaper class, adapted to supply power feed to attachments applied to the work table, apron or saddle of the machine. The attachments, as a revolving or circular table or cone arbors are mounted either on the main table or apron of the machine and provide a rotatable work holder or spindle to increase the scope of the work of the shaper and adapt the machine in many instances to productive work.

The table or apron to which the attachments are applied are provided with the regular feeding mechanism for vertical and transverse or cross feeds with which the transmission mechanism for imparting a circular feeding motion to the attachments connects, and therefore is of a character to accommodate for the various cross feed positions and elevations of the table or apron.

The invention is herein applied to a metal shaper of the reciprocating ram type in which the tool is reciprocated and the work intermittently fed transversely to the tool. Machines of this type are ordinarily only capable of performing planing operations for producing flat surfaces and for cutting flat walled straight grooves, the work in both instances being fastened to the carriage or table for translation across the tool path. However, it is sometimes desirable to plane cylindrical pieces longitudinally and to rotatably feed the work during this operation in synchronism with the ram.

The present invention provides means in the form of an attachment by which work can be rotatably supported and fed in synchronism with ram motion.

A feature of the invention resides in a novel construction of feed screw driving and reversing mechanism.

Another feature of the invention resides in the novel construction and operation of one portion of the apron cross feed screw driving and reversing mechanism providing a coupler gear for alternately throwing the transmission for the attachments or apron cross feed screw into and out of commission.

The transmission coupling comprises a sleeve translatable upon the feed screw shaft which has a terminal gear for transmittably connecting the sleeve with the corresponding terminal gear of the driving train of the attachment. The sleeve is loosely journaled upon the feed shaft, and adapted to engage a castellated portion of the feed shaft for transmittingly connecting the sleeve with the feed shaft. A casing for enclosing the attachment transmission is provided with means engageable with the gear or sleeve to prevent coupling engagement between sleeve and screw when the attachment is in use and to positively hold the sleeve and gear thereon in proper relation for engagement by the terminal gear of the driving train, and also providing independent means for positively retaining the coupler element in either of its translatably adjusted positions.

The attachment provides means whereby the work may be rotated and fed in synchronism with ram movement and in addition the work may be disposed at any desired angle to the tool.

The device further provides extensible and flexible or articulated driving connection between a rotatable work support and the driving mechanism of the feed screw, this driving connection being attachable or detachable with and from the feed shaft operating mechanism which is modified in such manner that in order to transmittably connect the work rotating attachment, transmission connection between the feed screw and feed screw transmission mechanism must be interrupted.

Other objects and certain advantages will be more fully set forth in the description of the accompanying drawings forming a part of this specification, in which:

Figure 1 is a general view of the device attached to a shaper, only a portion of the shaper being shown.

Figure 2 is an end view of a shaper equipped with my work rotating attachment.

Figure 3 is a detail sectional view of the rotatable work holder.

Figure 4 is a vertical section on line 4—4, of Fig. 3, illustrating the gearing.

Figure 5 is a vertical section substantially on line 5—5, of Fig. 1.

Figure 6 is a section at right angles to Fig. 5 approximately on line 6—6, of the figure.

Figure 7 is a detail view of one of the universal joints of the transmission shaft.

Figure 8 is a detail view illustrating the swiveled connection of the reversing gearing housing with the saddle.

Figure 9 is a fragmentary detail section similar to Figure 5 showing the driving sleeve coupled for rotating the cross feed screw.

The general structure of the shaper may be of any commercial form, having a transmission connection from the gearing carried by the body or main frame of the machine for reciprocating the ram to the cross feed screw of the apron, vertically and horizontally translatable upon the forward end of the body. The body of the shaper is indicated at 1, the ram at 2, the saddle at 3 and the work table or carriage at 4. The ram is operated in the usual manner by a crank gear and pitman, these details not being shown herein inasmuch as they form no part of the present invention, it being deemed sufficient for this purpose to show only those portions of the shaper which relate to the holding of the work; to the power transmission; and to the work rotating and feeding attachment and manner of connecting the same, which form the main features of this invention.

An improved carriage or table is used herein and has the form of a universally adjustable or swinging work support. The table 4 is of a type rotatively mounted upon the apron 4^a gibbed upon the cross rails of the saddle 3 and micrometrically adjustable about a horizontal axis 5 in the form of a trunnion attached to and extending outwardly from the apron, and is further provided with work supporting faces at right angles to each other; one of the faces being provided upon a block 6 adjustable axially right-angularly of the axis of rotation of the other adjustable portion of the unit.

The details of construction of the adjustable work table are made subject matter for separate application and therefore the interior arrangement including the detail of the adjusting device, is not herein more fully shown or described.

The work table, however, is rotatable about the horizontal axis 5 and provides a plane face 7 to which the work may be attached in the ordinary manner, and in addition a second work supporting surface or face carried by the adjustable block 6, thus adapting the holder for supporting the work for the universal adjustment. Thus the work table may be tipped or rocked in small degree either longitudinally or transversely.

When the block 6 is in a mid-position the work faces are related as the sides of a cube and said block is usually locked in this position when the work rotating attachment is used.

The cross feed screw 10 is operated through a transmission train consisting of a reversing gearing mechanism suitably mounted in a housing detachably and rotatably secured to the saddle concentrically with the feed screw. The driving connection between this reversing mechanism and the crank gear is not herein shown, inasmuch as it forms the subject matter of another application which relates particularly to the carriage feed transmission mechanism. In order, however, to illustrate the manner in which the rotative attachments can be used in conjunction with a portion of the aforesaid transmission mechanism, that portion including the reversing gearing housing is illustrated herein.

The saddle 3 is mounted to slide upon vertical ways 11 in the usual manner and the cross feed screw 10 is rotatably non-translatably mounted in the saddle and operates in the usual manner when rotated to traverse the work table. The saddle is extended laterally and is bored as at 15 in its outer face concentrically with the feed screw. Within this bore is engaged a tubular extension 16 of the gear housing and attaching member 17, to which the reversing gear housing is detachably secured, and to which the transmission unit of the attachment herein is adapted to be attached and rest upon. The first mentioned housing 17 is non-rotatably attached to the saddle by screws its configuration being best shown in Figs. 5 and 6.

The housing comprises a hollow body portion having an attaching flange 18 extending laterally therefrom through which are engaged screws for holding the same in position against the vertical side face of the saddle (see Figs. 5 and 6). The outer wall of the housing is provided with a circular bearing opening 20 having segmental, arcuate, diametrically related locking projections 21 interiorly thereof adapted for engagement by corresponding grooves 22 formed circumferentially of the tubular extension 23 of the reversing mechanism housing 25, whereby the housing can be engaged with or disengaged from the housing or support 17 and rotatably locked or swiveled thereto to permit compensating adjustment between the housings when the saddle is raised or lowered.

The reversing mechanism is connected through a telescopically arranged transmission shaft, with the ratchet feed mechanism mounted adjacent and operable by an extension of the crank gear. This transmission connection is not however illustrated herein.

The housing and support 17 is open at the top for the reception of the terminal gear of the driving unit of the attachment which gear is adapted to mesh with a gear of the cross feed screw driving sleeve, as hereinafter fully explained. A removable cover 26 closes the opening and has a depending projection 27 adapted to engage the gear 28 at the extremity of the reversing drive

sleeve 29, to hold the sleeve in driving engagement with castellations of the feed shaft, at times when the machine is being used in the ordinary manner, this condition being illustrated in Fig. 9 in which the gear 28 at the end of the sleeve 29 is engaged with the castellations 30, and the lug of the cover engaged with the periphery of the gear to positively prevent such translation thereof as would interrupt cross feed screw actuation.

In assembling, the bearing element 17 is properly engaged with the housing by turning the same to the position in which the circular grooved portion of the housing may be inserted within the bore after which the element is rotated through an angle of approximately 180° to bring the arcuate projection into locking position within the slots. After this operation the element is fastened to the saddle by screws, as shown in Fig. 6.

This locking arrangement per se forms no part of the present invention, the mechanism of the housing being shown as illustrative of the driving connection between the crank gear and the cross feed screw, it being understood that the ram and cross feed screw are operated in proper synchronism through their connection with the crank gear.

The cross feed shaft 10 is journaled in the saddle and adjacent one end is castellated at 30, the shaft being shouldered at one end of the castellations as at 36, by counterturning. Upon this counterturned portion is slidably mounted the driving sleeve 29 having a terminal spur gear 28 at its inner end provided with radial slots 37 in its outer face, engageable with the castellations for locking the sleeve for rotation with the shaft under ordinary conditions, the finger or projection of the housing acting to prevent disengagement of the sleeve, as before mentioned. Whenever the cover 26 is removed the sleeve can be translated outwardly to a position shown in Fig. 5, in which position it is uncoupled from the feed screw shaft and disposed to mesh with the terminal gear of the driving attachment as hereafter more fully explained. The feed shaft 10 however is adapted to be rotated manually by a crank handle inserted upon the squared end of the shaft.

Splined to the mid-portion of the sleeve is a reversing clutch element 40 adapted for alternate engagement with bevel gears 41 rotatably mounted upon the sleeve and constantly in mesh with the driving gear 42 suitably connected with the driving shaft, in turn in transmission connection with the crank gear, not shown. The clutch collar is centrally grooved and has engaged therewith a pin, at one end of a shifter lever 43, whereby the collar can be thrown in either direction from a neutral position for clutching to obtain reverse movements of the sleeve.

The feed screw extends beyond the housing and has pinned thereto a retaining sleeve, upon which is rotatably mounted a dial which may be set in any desired angular relation to the shaft by means of the set screw.

The work holding portion of the attachment is adapted to be bolted to either one of the faces of the universal work holder, but as shown herein is bolted to the adjustable block. Transmission gearing is provided, one member of which has splined connection with a driving worm of the work holder permitting cross-feed adjustment of the carriage while constantly maintaining the driving connection, this connection being in the nature of a spline.

The rotatable work holding portion of the attachment (see Figs. 1 to 4, inclusive) comprises a relatively broad base section 45 having openings therethrough for clamping bolts 46 which are adapted for engagement with the work attachment T-grooves provided in the working faces of the universal carriage or rest 4. The base is herein shown as attached to the adjustable block 6 and said base has integral therewith at one side an upstanding bearing block or pedestal 47 suitably bored at its inner end to form a bearing for the work carrying shaft or arbor 48, said shaft being rotatably supported therewith and having attached at its innermost end a worm gear 49 in mesh with a companion worm 50 splined to a driving element 51, as a member of the flexible transmission shaft. The worm gear 49 abuts the pedestal and the gear 50 is held against lateral movement in a suitable housing 52 preferably formed integral with the pedestal, a removable cover being provided at one side thereof. (See Figs. 3 and 4.) The work carrying arbor or shaft has an abutment flange 55 engaged against the opposite side of the pedestal bearing 47 and mounted upon the arbor and non-rotatably engaged on the counter-turned portion of the same is a cone member 56 adapted to enter the bore on the work and support the same at that end concentrically with the arbor axis. The outer end of the arbor is counterturned to form a shoulder and the same is threaded inwardly from the shoulder as at 57 and engaged with the threads is a second conical centering member 58 adjustable upon the shaft and engageable within the bore of the work to clamp the same between the cones, as shown in dot-and-dash lines in Fig. 1. A jam nut 59 prevents loosening of the cone member after adjustment.

The outer end of the shift is journaled in an adjusting pedestal bearing 60 which is adapted for removal and replacement respectively when removing or setting the work, its inward movement being limited by the shoulder 61. For this purpose the base is T-slotted longitudinally and parallel with

the arbor axis as at 62 for the reception of the head of a clamping bolt 63 extending upwardly through the bearing for properly securing the same, said bearing having a guide projection engaged within the slot to prevent lateral or rotative movement. The driving gearing is mounted in the frame which as a unit may be attached to the saddle and housing 17, and when so attached is adapted to have its terminal gear in driving engagement with the terminal gear 28 of the driving sleeve 29, which sleeve, as shown in Fig. 5, is then disengaged from the feed screw to prevent cross feed screw actuation while the attachment is in use.

That portion of the device containing the driving gears and including a sprocket chain, comprises two sections in the form of hollow housing or casing members, the lowermost of which 65, is attached to the saddle and rests upon the top of the casing 17, after the gear retaining cover has been removed. The lower casing has a right-angularly disposed extension 66 attached by suitable bolts to the front face of the saddle, and this casing has two horizontally disposed stub-shafts respectively 67, 68, extending therefrom, upon the lowermost of which is rotatably mounted a spur gear 69 which extends through the casing and below the same for engagement with the gear 28. (See Fig. 5.)

The casing 65, moreover, has a depending projection 73 against one face of which the spur gear 69 lies, the said projection extending below the gear and having the same face engaged with the end face of the gear 28, to hold the gear against translation to such a position as would permit the same to be transmittably connected with the feed shaft.

The upper casing element or section 70 is attached at the side and upper part of the lower section and houses a spur gear 71 rotatable upon the shaft 68, this gear being in mesh with the first mentioned gear 69 and having formed at its outer end sprocket teeth 75. The upper casing member, as a sprocket chain housing, is bored and fitted over the upper stub-shaft 68 and is held by a bolt as shown, as well as by a nut in threaded engagement with the stub-shaft 68. The upper portion of the housing has a sprocket wheel 78 pinned to a driving shaft 79 as a part of a flexible transmission connection between the sprocket wheel 78 and worm 50. The sprocket wheel 78 is held from lateral motion by bearing plates 80 in which the shaft 79 is supported. The bearing plates are attached at relatively opposite sides of the casing by screws. The outer end of the shaft is squared for the reception of a crank by which the shaft may be manually rotated. A sprocket chain 81 is engaged with the sprocket wheels, 75, 78 the arrangement being best shown in Fig. 6. A universal jointed shaft section 82 is provided to transmittably connect the shafts 51, 79 as shown, thus providing means whereby proper driving connection between the shafts can be maintained in all adjusted positions of the work support or work.

A device is thus provided which may be readily attached to a shaper or machine of similar nature, by means of which the work, for example, cylindrical pieces, can be axially rotated or fed in synchronism with the ram movement without change in the feeding mechanism, other than the disconnection of the same with the feed screw, this disconnecting operation acting to dispose a driving gear carried by the feed screw driving sleeve in a position to be meshed with the terminal gear of the attachment, when the same is mounted in operative position upon the saddle. Moreover, the angle of the axis of the work may be changed by tilting the adjustable block of the work support. For example, if it is desired to cut tapered slots in a piece, it is only necessary to properly angularly adjust the block 6 whereafter by ordinary shaper operation a groove or slot of such character may be cut. In addition peripheral circular bottom slots may be cut, extending through any number of degrees.

The transmission attachment between the screw shaft 10 and the flexible shaft 51 and including the flexible shaft 51 serves for all of the attachments to be applied upon the table in which rotative motion is required. For attachments applied directly upon the face of the apron the housing section 70 can be swung to different angles about the stud shaft 68 as an axis to bring the flexible shaft 51 at any elevation required and below that of the shaft 68 and held in place by the bolt 83, engaged into the lower housing section 65, the lower housing section 65 being provided with threaded bores to respectively receive the bolt 83 to secure the upper housing section at definite adjusting positions.

Having described my invention, I claim:

1. In a machine of the class described, a work table, a cross-feed screw shaft therefor, transmission mechanism for said screw shaft, including a driven sleeve slidable upon said shaft for clutching control with said shaft, cooperating clutch elements carried by said shaft and sleeve respectively for transmittingly connecting and disconnecting said sleeve and shaft, a work support mounted upon said work table including a rotatable work supporting arbor, and articulated extensible transmission mechanism transmittingly connecting said sleeve and arbor when said sleeve is disconnected from the feed shaft.

2. In a machine of the class described, a work table supporting cross rail, a work table slidable upon said cross rail, a screw shaft journalled upon said rail for feeding

the work table upon said rail, a sleeve slidably mounted upon said screw shaft, cooperating clutch elements carried by said shaft and sleeve respectively for transmittingly connecting and disconnecting the same, motion reversing gears loose on said sleeve, a sliding clutch on said sleeve for alternately connecting said motion reversing gears to said sleeve, a gear fixed on said sleeve for making an auxiliary transmission connection therewith, and casing means for engaging a side face of said gear for maintaining a clutched relation between sleeve and shaft when said gear is not utilized in effecting an auxiliary transmission.

3. In a machine of the class described, a work table, a cross-feed shaft therefor, transmission mechanism for said shaft including a driven sleeve slidable and rotatable upon said feed shaft, said sleeve adapted to be clutched to and unclutched from the shaft by translation in opposite directions, a gear carried by said sleeve slidable and rotatable therewith, a work supporting arbor rotatably mounted upon the work table and articulated extensible transmission mechanism connecting said arbor and gear carried by said sleeve including a supporting casing having a terminal gear meshing with the sleeve gear, and a depending finger for engaging and holding said gear and sleeve in non-clutched position relative to the shaft for rotation independently of the feed screw when the attachment is in use.

4. In a machine of the class described, a saddle, a work table upon said saddle, a feed screw for said work table, a driving sleeve for the feed screw slidable and rotatable thereon, said sleeve adapted in one translated position to rotate the feed screw and in another position to rotate thereon, a gear carried by said sleeve translatable and rotatable therewith, a casing attached to the saddle surrounding said sleeve and feed screw having a slot for access to said gear carried by said sleeve, a rotatable arbor upon the work table, and extensible flexible transmission means connecting said arbor and sleeve, said means including a terminal gear projecting through said slot engageable with said gear carried by said sleeve, and a casing for said transmission means having a projection engageable through said slot of said first named casing for holding said sleeve against transmission.

5. In a device of the class described, a saddle, a work table upon the saddle, a feed screw therefor, a casing attached to said saddle concentric with the feed screw having a slot therein, screw transmitting and reversing mechanism including a driven sleeve translatable and rotatable upon the feed screw adapted in one position to rotate the feed screw and in another position to rotate thereon, cooperating clutch elements carried by said feed screw and sleeve for connecting the same, said sleeve having a spur gear thereon adapted to be disposed opposite the casing slot when said sleeve is rotatable upon the screw shaft and gearing as a transmission unit removably mounted upon said saddle having a gear thereof for projecting through said casing slot and connecting with said spur gear for driving mechanism mounted upon said work table.

6. In a machine of the class described, a saddle, an adjustable work table thereon, transmission mechanism for operating the work table including a feed screw, a driving sleeve rotatable and translatable upon the feed screw, adapted for engagement therewith in one translated position and to be disengaged therefrom in another position, said sleeve carrying a gear adapted for driving an independent mechanism, when the sleeve is in non-transmission connection with the shaft, a rotatable work holder mounted upon the table, and universal extensible transmission means connecting said work holder and sleeve, including a terminal gear engageable with said gear carried by said sleeve only when said sleeve is in non-feed-screw transmitting position.

In witness whereof, I hereunto subscribe my name.

ROBERT T. HAZELTON.