AUTOMATIC BAR STOCK MACHINE

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This invention relates to the provision of an automatic bar stock machine and is directed more particularly to such a machine where a bar or bars of stock are fed forwardly and clamped in a rotating spindle so that an object is formed on the end of the bar and then cut off.

According to certain novel features of the invention, the machine is characterized by its rigidity, efficiency and ease of operation thereby facilitating maximum production.

According to other novel features of the invention, the various components are related in such a way that ample room is provided to obviate the difficulties usually encountered with chips.

According to another novel feature of the invention, plural work spindles are operated from a common source of power thereby conserving power, floor space and operator convenience as distinguished in line and spindle machines.

As further features of the invention, the tool carriers are readily accessible and it is possible to form different pieces on the different spindles simultaneously.

Various and numerous novel objects and advantages will be observed in connection with the following description of the invention in the form as now preferred, it being understood that various changes and modifications may be made without departing from the spirit and scope of the invention.

In the drawings—

Fig. 1 is a front elevational view of a machine embodying the novel features of the invention;

Fig. 2 is an end elevational view of the machine shown in Fig. 1 taken at the power end thereof;

Fig. 3 is a sectional elevational view on the line 3—3 of Fig. 1 to illustrate the driving mechanism;

Fig. 4 is a developed sectional plan view on the line 4—4 of Fig. 2;

Fig. 5 is a plan view on the line 5—5 of Fig. 1 to illustrate the brake mechanism;

Fig. 6 is an enlarged end view of the over-running clutch of the driving mechanism;

Fig. 7 is a front elevational view of the brake mechanism shown in Fig. 5 taken outside the wall of the power housing;

Fig. 8 is a sectional elevational view on the line 8—8 of Fig. 6;

Fig. 9 is a sectional elevational view on the line 9—9 of Fig. 1;

Fig. 10 is a partial front elevational view on the line 10—10 of Fig. 9;

Fig. 11 is a front elevational view of the bar stop and Fig. 12 is a sectional elevational view on the line 12—12 of Fig. 11;

Fig. 13 is a sectional elevational view on the line 13—13 of Fig. 1;

Fig. 14 is a sectional elevational view of the head stock of the machine taken on the longitudinal center line thereof and on the line 14—14 of Fig. 15;

Fig. 15 is a sectional plan view through the head stock shown in Fig. 14 and on the line 15—15 of Fig. 14;

Fig. 16 is an elevational view of the inner side of the head stock and on the line 16—16 of Fig. 1;

Figs. 17 and 18 are elevational views of the front working and rear faces of a cam for operating one of the cross slides; and

Fig. 19 is a sectional plan view on the line 19—19 of Fig. 16.

Referring now to the drawings more in detail, the invention will be fully described but the machine will first be described in general in connection with Fig. 1 wherein a base construction is indicated by 2.

A power case or housing 4 with which driving mechanism is associated is fixed to the right-hand end of the base construction. This may be called the power end of the machine.

A head stock 6 is fixed to the opposite or tool end of the base construction which is connected to the housing 2 by a longitudinal strut 8.

A motor 10 is fixed to the housing 4 and through mechanism to be described longitudinal inner drive and outer cam shafts are operated therefrom. The outer cam shaft has a cam drum 12 fixed thereto and said shafts extend into the head stock for operating the spindles, etc., all as will later be described.

The cam drum 12 has a cam 14 for moving a tool slide 16 for end tools back and forth, a cam 18 for operating stop mechanism for bar stock, a cam 20 for operating high speed clutch mechanism and associated parts and a brake mechanism 22 all of which will presently be described.

The power mechanism will now be described with particular reference to Figs. 2, 3 and 4 to 10 inclusive.

A shaft 24 of the motor has a pulley 26 fixed thereto that is connected by a belt 28 in engagement with a pulley 30 fixed on a shaft 32. This shaft 32 may be called the high speed shaft and it is journaled in inner and outer walls 34 and 36 of the housing, see Fig. 4.

A pinion 38 fixed on shaft 32 is in mesh with an idler 40 rotateable on a stud 42 of wall 36. Said idler 40 is in mesh with a gear 44 fixed on a shaft 46 journaled in the wall 35. A gear 48 fixed on said shaft 46 meshes with a gear 50 fixed on a shaft 52.

The shaft 52 is journaled in the wall 36 of the housing 6 and extends longitudinally into the head stock. It will be called the main drive shaft and is rotated from the motor through the belt-pulley and gearing described at all times while the motor is in operation.

A pinion 54 fixed on shaft 52, see Fig. 4, meshes
with a gear 56 which has a pinion 58 fixed there- 
to. A gear 60 fixed on a shaft 52, rotatable in 
the housing wall 33, is in mesh with the pinion 
58 and said shaft has a gear 54 fixed there- 
to which is in mesh with a pinion 65 of an inner 
clutch member 56 which is rotatable in the 
wall 33.

Thus through the belt pulley and gear con- 
nections described, the clutch member 56 is ro- 
tated when the motor is in operation.

The clutch member rotatably receives an end 
of a shaft 70 which has its opposite end jour- 
nalled in the wall 34. Said shaft may be called 
the low-speed feed shaft.

A friction clutch mechanism 72 which may be 
called the high-speed clutch is associated with 
the high-speed shaft 32. This may be of usual 
form adapted when engaged to clutch a sprocket 
74 to said shaft 32 as a collar part thereof 
and moved downwardly into clutching position by a 
rod 78 which is slidable back and forth relative 
to wall 34.

A chain 85 is in engagement with sprocket 74 
and with a sprocket 22 associated with an outer 
part 64 of the overrunning clutch 66 of which 
inner part 65 is a component.

A friction clutch 83 operable by a collar 90 has 
a part carrying a sprocket 22. The clutch 86 
meant of any well known type adapted as its 
collar 85 is moved back and forth to engage and 
disengage the sprockets 82 and 92.

The overrunning clutch, best shown in Fig. 6, 
includes the usual inner member 88-having the 
inclined sockets 84 and rolls 85.

When the high-speed clutch 72 connects the 
sprocket 74 to the high-speed shaft 32 and the 
clutch 86 is engaged, the sprocket 92 is driven 
at high speed and the outer member 64 of the 
overrunning clutch overruns the inner member 
65 thereof which is driven through the gearing.

When clutch 72 is disengaged the sprocket 92 
is driven at low speed through the gearing and 
overrunning clutch 66.

A hollow shaft 103 surrounding the shaft 52 
and called the cam-shaft has an end journaled 
in housing wall 34, as shown in Fig. 4, with a gear 102 
fixed thereon. A spider 101, rotatable on the 
shaft 103 has pinions 105 which are in mesh 
with a gear 106 fixed to wall 34 in any conven- 
tient manner and in mesh with gear 102.

A sprocket 116 is frictionally engaged be- 
tween spider 104 and a plate 112 and is con- 
ected by a chain 114 to sprocket 32. The gears 
102 and 168 are preferably provided with fifty-
eight and fifty-six teeth respectively. The fric- 
tional action of the members 102, 112 and 116 
may be varied by means of adjusting screws, and 
as the sprocket 116 is rotated the spider 104 is 
driven through friction so that through the pin- 
ions and gear 106 the gear 102 is driven to rotate 
the cam shaft at high or low speed accordingly 
as high speed clutch is engaged or disengaged.

It is desired to provide means for hand crank- 
ing sprocket 92 and thereby the cam shaft to 
and that end the following is provided, see Figs. 
4, 9 and 10.

A gear 115 is fast to sprocket 92 which meshes 
with a pinion 120 that is rotatable with a gear 
122 on a shaft 124 of the housing. An idler gear 
126 is in mesh with gear 122 on a shaft 128 which 
is slidable in the housing. A spring pressed de- 
tent 130 is spring pressed, as shown, into en- 
gagement with circumferential grooves 122 of 

A connected together pinion 134 and sprocket 
136 are rotatable on a stud 138 and the said 
sprocket is connected by a chain 140 to a sprocket 
142 fixed to a shaft 144 which is rotatable in 
the housing. A crank 146 is provided on said 
shaft 144.

A transverse shaft 148 is oscillatable in the 
housing and carries a fork 150 in engagement 
with the part 152 of the clutch 86. An arm 152 
is fixed on said shaft 148 as is operating levers 
154 on opposite ends thereof.

With the parts as shown in Figs. 9 and 10, the 
shaft 148 may not be oscillated to clutch engag- 
ing position, or counterclockwise as the arm 152 
will on such movement of the shaft 148 bring 
up against idler 126. In this position the gear 
118 and sprocket 92 may be rotated through the 
gearing and sprocket-chain connections by ro-
tation of the crank 146.

To permit the clutch 88 to be engaged, by 
swinging of lever 154 to the left in Fig. 10, the 
shaft 152 and thereby the gear 126 may be moved 
outwardly to disconnect gears 122 and 134 and 
remove the gear 126 from in front of arm 152.

Thus clutch 88 cannot be engaged while the cam- 
shaft 100 is being hand-cranked and the crank- 
ing mechanism is inoperative when clutch 88 is 
engaged.

The spindle mechanism and driving arrange- 
ment therefor will be described in connection 
with Figs. 14 to 19 inc.

The head stock includes a housing having 
inner and outer walls 160 and 162, side walls 164 
and a rearwardly extending part 166 with a cover 
163 around the upper part thereof.

The cam shaft 100 is journaled in the wall 160 
and the end of the main drive-shaft 52 extends 
therebeond and is journaled in an anti-friction 
bearing 170 of wall 162. A stationary shaft 172 
is carried by the wall 162 and extension 166, as 
shown, and will be held against movement by any 
suitable means, such as a set screw, in the part 
166 in engagement therewith.

An upper cam shaft 174 and a lower cam shaft 
176 are journaled at opposite ends in the walls 
160 and 162.

Upper and lower cross-slides 178 and 180 
are slidably and by means of gibbs 182 asso- 
ciated with the wall 160 and transversely of the 
axis of the shafts 52 and 100. The upper slide 
178 may be the cut-off slide and is provided with 
pads 183 provided with T-slots 186 in which cut- 
off tools or tool holders may be clamped. This 
cut-off slide moves back and forth and as it 
moves to the left in Fig. 16, the tools carried thereby 
may operate on a bar of stock carried by spindles 
S to cut-off an object formed on the end portion 
thereof.

The lower slide 180 may be the forming slide 
and is provided with pads 188 having T-slots 
190 in which tools or tool holders may be clamped. 
As this slide moves to the right in Fig. 
16, the tools carried thereby may operate on and 
form an object on the ends of bars of stock car- 
ried by the spindles S.

Cam discs 182 are fixed to the shafts 174 and 
176 for operating the slides described. These cam 
discs may have outer and inner cam members 
184 and 186 secured to the face thereof to pro- 
vide a roll groove. A gear such as 198 is asso- 
ciated with each cam which meshes with a gear 
202 fixed on the cam shaft 100.

The gears 195 are provided with a plurality of 
bolt receiving holes 200 and the cam discs are 
provided with tapped holes 204. The holes of 
the gears and of the cams are spaced so that
The slides have rearwardly projecting hubs 268 extending through slots 269 in wall 160 which carry studs 210 on which are cam rolls 212 engageable by the cams 194 and 198, see Fig. 17. As the cams are rotated the forming and cut-off slides are moved back and forth.

The spindles S are rotateable on axes disposed at either side of the shafts 252 and 172, see Fig. 15. The spindles may be of usual form having hollow collets 214 in their forward ends that are contracted to grip a bar of stock and allowed to expand to release said bar. Said spindles are journaled in the walls 160 and 162 by means of anti-friction bearings 216 and 218, as shown.

Stock feed tubes 218 and 218," extend from the outer rear ends of the hollow spindles and through bearings 229 and have grooved collars 222 on the outer ends thereof. Grooved collars 224 on the spindles S are associated with the draw tubes thereof for contracting the collets.

A member 228 slideable back and forth on the shaft 172 has fingers 227 engaging the grooves of collars 222 and a member 226 slideable on said shaft has fingers 228 engaging the grooves of collars 224. As the member 226 is moved forwardly or to the right in Fig. 15 the bars of stock are fed forwardly in the spindles. As the member 226 is moved rearwardly or to the left in said figure the collets are contracted for gripping the bars for rotation thereof.

Rotors 252 and 228 are provided on the slideable members 226 and 228. A tension spring 234 has opposite ends connected by members 236 and 238 to the slideable member 226 and the wall 162, as shown in Fig. 14. This spring urges roll 227 into engagement with a cam pad 249 of a cam drum 242 which is fixed on shaft 174.

Cam pads 244 and 246 on said cam drum 242 act on roll 229 to move member 226 back and forth.

A gear 248 on shaft 172 meshes with gears 250 on the spindles S, see Fig. 19 and as shaft 172 rotates said spindles are rotated. Likewise when the cam shaft 185 is rotated the upper and lower shafts 174 and 178 are rotated thereby to move the slides back and forth while the collet actuating member and feed member 228 and 224 are operated by rotation of said shaft 174.

The strut 2 is connected at one end by bolts or some suitable means to the wall 160 while its other end is similarly connected to the housing 4.

Stops are provided for the slides 178 and 189, as shown in Fig. 18. Straps 256 adjacent one end of the slides are secured to wall 160 by screws 258 and stop screws 260 are adjustable in said straps which have end portions 252 receivable in holes in the slides. At the other ends of the slide screws 264 which are adjustable in blocks 266 carried by the slides have flanges 269 between which and adjustments 272 secured to the wall 160 are screws 270.

The members 224 of the spindles for operating the spindle collets may be manually operated as in Fig. 15. Shafts 276 having squared outer ends 278 for receiving a hand lever and have levers 260 secured to inner ends thereof which are held by screws 222 and the members 224. By oscillating shafts 276 the members may be moved back and forth to open and close the collets.

Stop means for the bars of stock in the spindles will now be described with reference to Figs. 11 and 12. The strut 8 is provided with longitudinal grooves 286 on its opposite sides in which tongues 287 of brackets 288 are slideable. Screws 290 receivable in holes 292 in the strut are provided to clamp the brackets 288 in adjusted positions. The brackets have generally vertically disposed guides 294 in which there are guides for slides 295 with plates 293 overlying the guides. A crank 300 is pivoted at 302 to ears 304 of the brackets 294 and lower arms 301 of the crank have end portions that are receivable in sockets 305 of the stop slides 295. Springs 303 in grooves 310 of one side of the slides are disposed above screws 312 of the brackets to urge the slides upwardly.

The lower ends of the stop slides 296 are arranged when the slides are in lower stop positions to lie in front of the spindles S and against which the ends of the bars of stock are thereby to stop feeding of the bars and position them for the machining operation.

The crank is swung counterclockwise to move the stop slides downwardly while the springs tend to urge the slides upwardly. The brackets 288 are adjustable back and forth to vary the length of feed of the bars of stock.

A rod 308 is slideable in bearings 310 of the strut 8, see Fig. 1. One end of the said rod carries a cam roll 312 which is operably related to the cam 18 and its other end is pivotally connected to a link 314 which in turn is pivotally connected to crank 300. Various holes are provided in the link 314, as shown, for connecting to the crank 300 to accommodate adjustment of the brackets 288. As the cam 18 rotates the rod 308 is reciprocated to bring about swinging of crank 300 thereby to operate the stops 296.

The slide 16 for the end tools will now be described with particular reference to Figs. 1 and 13.

The said slide 16 is slideable between gib 320 and it has an upper head portion 322 through which the cam shaft 109 and drive shaft 52 extend. T-slots 324 in opposite sides thereof are provided in which a tool-holder or tool may be secured for operating on the ends of bars of stock in the spindles. A roll 326, see Fig. 1, is carried by said slide 16 which is in engagement with cam 14. The rotation of the cam moves the slide back and forth to bring the tools carried thereby into the bars of stock.

The brake mechanism will now be described with reference to Figs. 1, 4, 7 and 8.

A brake drum 330 is associated with the cam drum 12 rearwardly of cam 20 thereof and a brake band 332 is in frictional engagement therewith. A lever 334 is pivoted at 336 to the wall 34 and has an upper arm 339 and a lower arm 340. A rod 342 secured to one end of the brake band passes through lever part 338 and a spring 344 is disposed thereon between lever part 338 and nuts 346. The other end of the brake band is connected to the lower end 330 of the lever 334. A manually engageable lever 348 is swingable at 359 in a horizontal plane and is connected at 352 to rod 78 for operating the high speed clutch 72. Said rod 78 is provided with a tapering cam member 354 which is adapted to engage the upper portion of lever part 332 of the drum 330 on the undersides of lever 348 is operatively related to cam 20 so that as the cam drum 12 rotates the lever 348 is actuated so as to operate the high speed clutch through rod 78 and also to act on lever 334 by
swinging it counterclockwise for applying the brake.

A latch 350 is pivoted at 352 and has an outer end for latching over and holding the lever 350 against swinging outwardly, see Fig. 3. A roll 344 on the inner end of the latch lever 350 is engageable by a cam patch 346 on cam 20 and as the cam rotates the latch is operated to release lever 348. A spring pressed detent 356 acts on the latch lever 350 to urge it downwardly into latching position.

The operation of the machine will now be described it being understood that the motor 10 is in operation and that bars of stock are clamped in the spindles 5 with inner ends thereof projecting outwardly for engagement by the tools for the machining operation.

The shaft 52 is driven through the gearing so that the spindles are rotated according to a speed depending upon the gear ratio.

The high speed clutch 72 is disengaged so that shaft 16 through the overrunning clutch 70 and gear 100 is rotated at low speed to rotate cam shaft 100 at low speed whereby the forming end tool slide and cut-off slide are operated in timed relation by their respective cams to form objects on the ends of the bars of stock and cut them off.

Subsequently the cam 20 brings movement of rod 76 to engage the high speed clutch 72 so that shaft 72 is driven through chain 50 at high speed thereby to drive cam shaft at a faster speed. Thereupon the cams of cam drum 240 operate the members 229 and 226 so that the collets are expanded and the bars of stock are fed forwardly in the spindles 5. The cam 16 operates the stop mechanism so that the stops 206 are in position in front of the bars of stock being advanced. Then the collets are contracted to grip the bars of stock.

With the bars of stock presenting inner ends beyond the spindles and on which objects are to be formed, the cam 20 operates lever 348 which through rod 78 disengages the high speed clutch 72 so that the shaft 72 and thereby the cam shaft 100 will be operated at low speed through the gearing and overrunning clutch. As rod 78 disengages the high speed clutch the cam 354 thereof acts on lever 324 to apply the brake band 332 thereby to retard cam shaft 100 as the driving connections are shifted from high to low speed operation.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely as being illustrative and not as being restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all modifications and variations as will fall within the meaning and purview and range of equivalency of the appended claims are therefore intended to be embraced therein.

What it is desired to claim and secure by Letters Patent of the United States is:

1. Operating mechanism for a machine tool having spaced work spindles and tool carriers slidable transversely relative thereto and work stops movable in and out forwardly of said spindle connections in combination, concentric relatively rotatable drive and main cam shafts in parallelism with said spindles, gearing connecting said drive shaft and spindles, upper and lower secondary cam shafts and gearing connecting the same to said main cam shaft, and cams on said secondary cam shafts for operating said tool carriers, a stop cam on said main cam shaft and connections between said cam and work stops, drive mechanism for said drive and main cam shafts including speed changing means for rotating the latter alternately at high and low speeds, and means operable by said main cam shaft for actuating said speed changing means.

2. Operating mechanism for a machine tool having spaced work spindles and tool carriers slidable transversely relative thereto and work stops movable in and out forwardly of said spindles comprising in combination, concentric relatively rotatable drive and main cam shafts in parallelism with said spindles, gearing connecting said drive shaft and spindles, upper and lower secondary cam shafts and gearing connecting the same to said main cam shaft, and cams on said secondary cam shafts for operating said tool carriers, a stop cam on said main cam shaft and connections between said cam and work stops, drive mechanism for said drive and main cam shafts including speed changing means for rotating the latter alternately at high and low speeds, and means operable by said main cam shaft for actuating said speed changing means, a brake drum rotatable with said stop cam and brake means engageable therewith, and means for operating said brake means.

3. Operating mechanism for a machine tool having spaced work spindles and tool carriers slidable transversely relative thereto and work stops movable in and out forwardly of said spindles comprising in combination, concentric relatively rotatable drive and main cam shafts in parallelism with said spindles, gearing connecting said drive shaft and spindles, upper and lower secondary cam shafts and gearing connecting the same to said main cam shaft, and cams on said secondary cam shafts for operating said tool carriers, a stop cam on said main cam shaft and connections between said cam and work stops, drive mechanism for said drive and main cam shafts including speed changing means for rotating the latter alternately at high and low speeds, and means operable by said main cam shaft for actuating said speed changing means, a brake drum rotatable with said stop cam and brake means engageable therewith, and means for operating said brake means actuated by said main cam shaft.

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