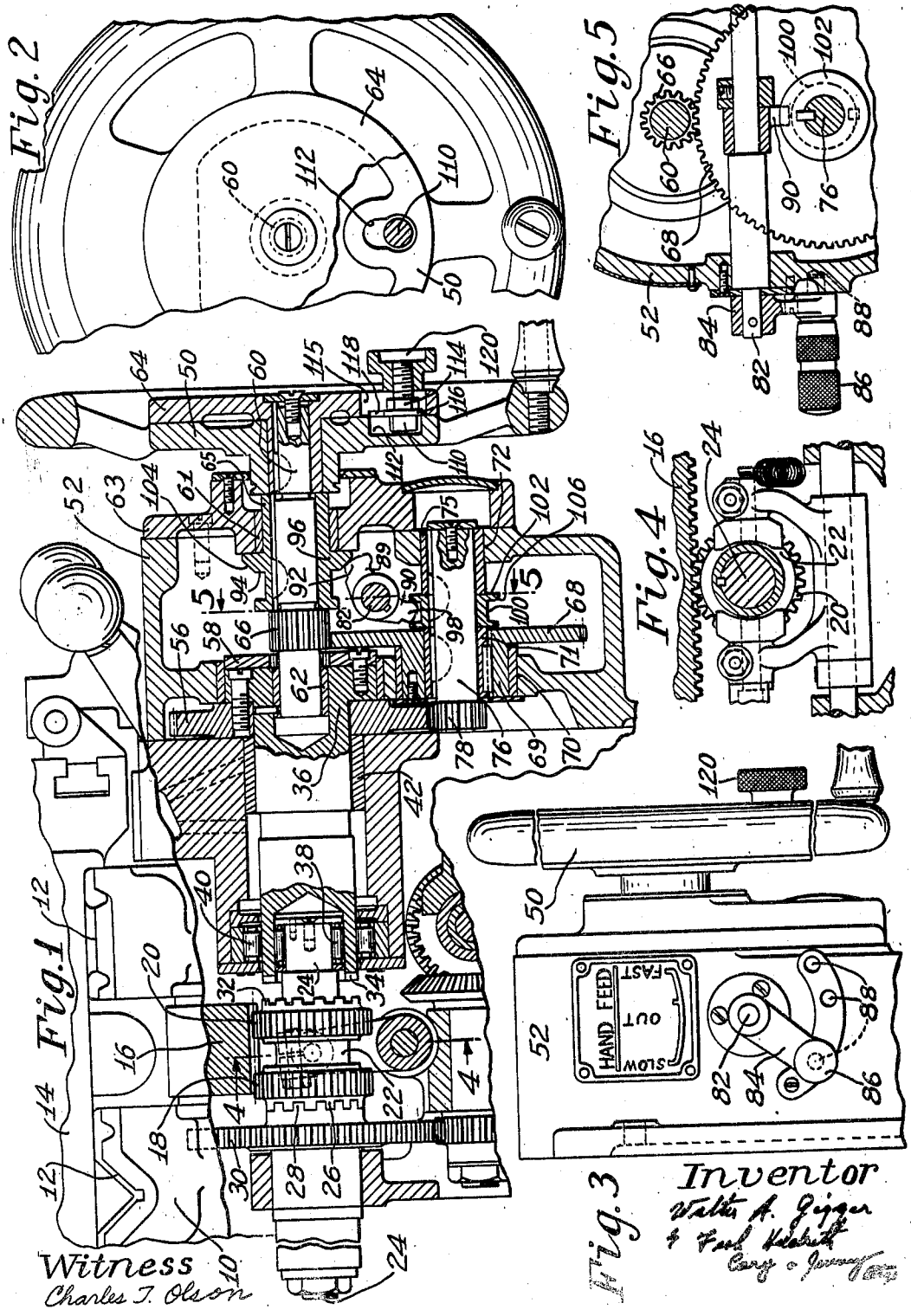
May 16, 1944. W. A. GIGGER 2,348,805

CONTROL DEVICE

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Fig. 6

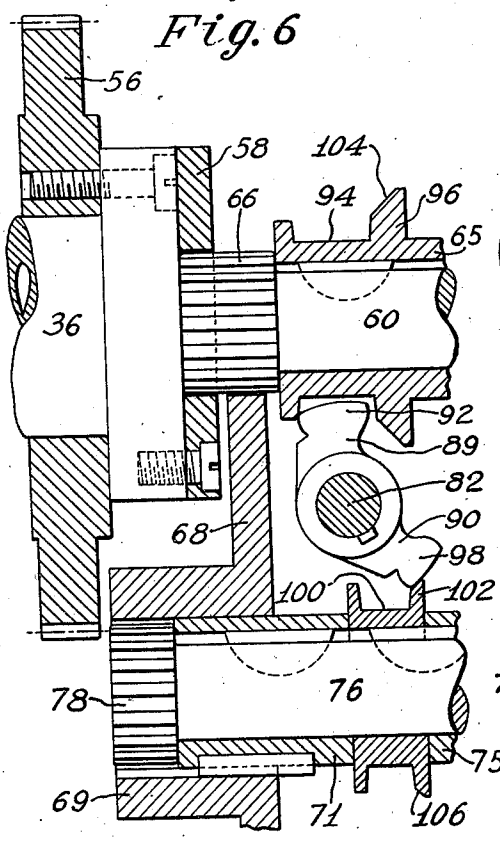
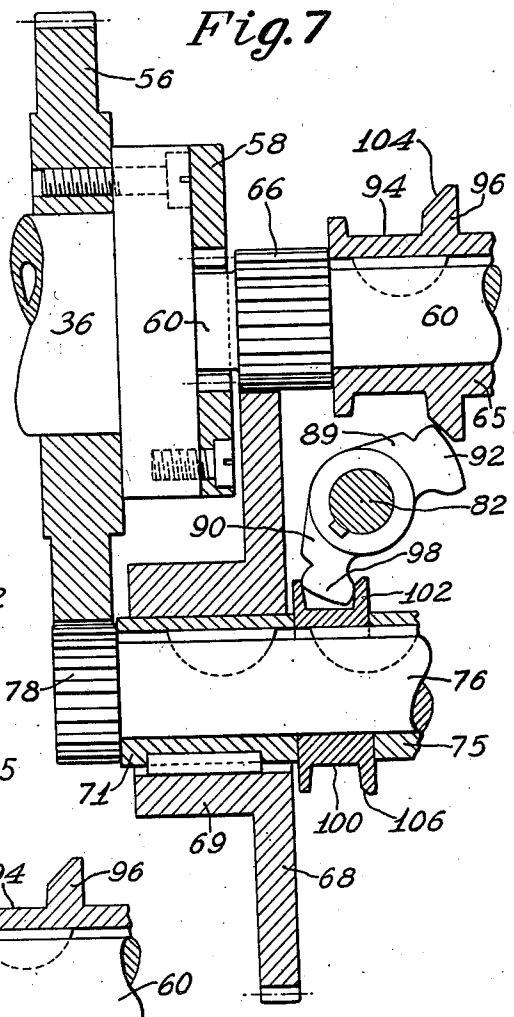


Fig. 7



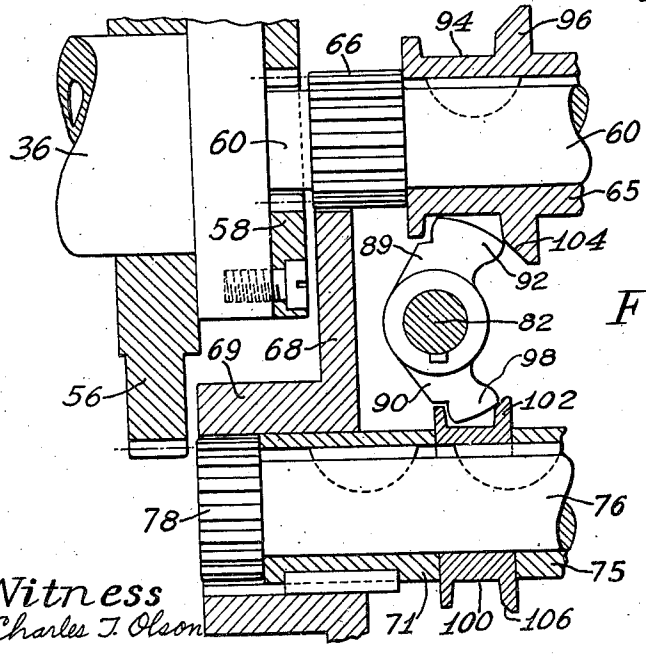


Fig. 8

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UNITED STATES PATENT OFFICE

2,348,805

CONTROL DEVICE

Walter A. Gigger, Barrington, R. I., assignor to Brown and Sharpe Manufacturing Company, a corporation of Rhode Island

Application November 29, 1941, Serial No. 420,989

15 Claims. (Cl. 74—475)

The present invention relates to improvements in control devices for movable machine tool supports, and is herein disclosed as embodied in a two-speed manual drive device for a reciprocable grinding machine work support. This device is of the general type which comprises a hand wheel and gear driving connections therefrom including high speed and slow speed driving gears alternatively shiftable into clutch position to drive the work support.

It is an object of the invention to provide in a variable speed transmission of this general description having a plurality of driving gears alternatively shiftable from inoperative to clutching positions, a novel gear shifting device which is efficient and certain in operation, and provides a simpler and more compact construction and arrangement of a variable speed gear transmission than may be found in the prior art.

In accordance with this object, applicant provides a high speed driving gear and a low speed driving gear mounted to be shiftable on parallel axes between clutching and inoperative positions, and a gear shifting device in the form of grooved spool portions associated with each of said gears, a rock shaft extending transversely of and between said spool portions, and a pair of rocker arms mounted on the rock shaft having segmental groove engaging end portions for engagement respectively with said grooved spool portions. A principal feature of the invention consists in the construction and arrangement of the grooved spool portions and rocker arms to cause each of the rocker arms to be disconnected from its groove when the associated gear has been moved to a predetermined inoperative position. The rocker arms are arranged to be brought into operative relationship with their respective grooves to shift the gears between clutching and inoperative positions during rotation of the rock shaft and rocker arms mounted thereon in different sectors of operation. In the illustrated construction, short rocker arms of equal length are employed. The distance moved by each gear from the clutching to the inoperative position in which the rocker arm is disconnected from the spool portion, is determined independently for each gear by causing the rock shaft and rocker arms to be rocked through a proportionate angle in each sector of operation.

Further in accordance with the invention, the rocker arms are provided with segmental recess engaging end portions, and the side walls of the recesses are shaped to cause the segmental surface of the rocker arm associated with the inoperative gear to be moved into blocking relation to the side wall of the recess to effectively block the inoperative gear from any movement towards its clutching position while the other of said gears is engaged. The length of each segmental surface is determined in accordance with the extent of rotational movement required to be imparted to the rocker arms to bring the alternate gear from its inoperative to its clutching position to maintain engagement of the segmental blocking surface with the associated inoperative gear.

It is another object of the invention to provide a novel and improved manual drive for a machine tool support including a manual actuating element and gear driving connections therefrom in which provision is made in the driving connections to permit the use of the manual driving element or hand wheel as a hammer available particularly with the slow speed drive of the device to inch the work support along by very slight amounts. In accordance with this object, applicant provides connection between the hand wheel and the gear driving connections whereby a knocking action may be set up between the hand wheel and these connections for inching the support ahead by very small amounts. This feature permits of a more accurate manual adjustment in the position of the table than has heretofore been considered possible because of the take-up or yield normally present in the gear driving connections which operates when overcome by rotation of the hand wheel to jump the table.

The several features of the invention consist also in the devices, combinations and arrangement of parts hereinafter described and claimed, which together with the advantages to be obtained thereby, will be readily understood by one skilled in the art from the folllowing description taken in connection with the accompanying drawings, in which Fig. 1 is a fragmentary view of a grinding machine looking from the left and partly in section, illustrating particularly applicant's improved two-speed hand wheel device for driving the work support; Fig. 2 is a detail view in front elevation showing a portion of the hand wheel illustrated in Fig. 1; Fig. 3 is a detail view in left side elevation showing the hand wheel and the casing within which is mounted the two-speed gearing and the gear shifting device for applicant's two-speed hand wheel device; Fig. 4 is a detail sectional view taken on the line 4—4 of Fig. 1, illustrating particularly the power-manual clutch for the work support; Fig. 5 is a detail sectional view taken on the line 5—5 of Fig. 1, illustrating particularly the reduction

gearing forming part of the two-speed hand wheel device; and Figs. 6, 7 and 8 are enlarged detail views illustrating the gear shifting device in each of three alternative positions, Fig. 6 showing the parts in the high speed position, Fig. 7 showing the parts in the slow speed position, and Fig. 8 showing the parts in the intermediate neutral position in which the hand wheel device is entirely disconnected.

The invention is disclosed in the drawings as embodied in a grinding machine which may be of ordinary description comprising generally a grinding wheel unit which may be of conventional type and is not shown, including a grinding wheel spindle and a supporting carriage movable transversely toward and away from the work, and a work supporting table which is longitudinally movable with relation to the grinding wheel. The base portion of the machine is indicated generally at 10 and has formed therein ways 12 on which is mounted a work table 14. Movement of the table is effected by means of connections which include a rack 16 secured to the under side of the table which is engaged by two gears 18 and 20 formed on a power-manual clutch sleeve member 22. The clutch sleeve member 22 is shiftable axially on a supporting shaft 24 between alternate power and manual feed positions. In the power position of the power-manual clutch, a clutch face 26 on the clutch sleeve member 22 is arranged for engagement with a power clutch element 28 formed on one face of a power driving gear 30 on the shaft 24. The sleeve member 22 is shown in the power position. Inasmuch as the present invention is not concerned with the power drive for the work table, no further description of the power driving mechanism is believed necessary. For the manual position of the power-manual clutch, a clutch face 32 on the clutch sleeve 22 is arranged for engagement with a clutch element 34 on the sleeved end of a connecting shaft 36 supported co-axially with shaft 24. As shown in Fig. 1, the shaft 24 extends within the sleeved portion of the shaft 36, being supported therein by means of a roller bearing 38. The shaft 36 is externally supported at this point by means of a roller bearing 40 mounted on the machine frame. The shaft 36 projects forwardly through the forward wall of the base 10 of the machine, being supported adjacent its forward end by means of a bushing 42.

Applicant's improved two-speed hand wheel device for the work table comprises a casing 52 which is mounted on the base 10 to extend over the forward end of the shaft 36, and provides support for a hand wheel 50 and gear driving connections including a two-speed gear shifting device through which the hand wheel is connected to drive the shaft 36 at either of two predetermined driving ratios. The driven elements through which the two-speed hand wheel device is connected to drive the shaft 36 comprise a driven external slow speed gear 56 secured to the shaft 36, and an internal high speed driven clutch gear 58 secured to the flanged outer end of shaft 36. The hand wheel 50 is carried on a drive shaft 60 which is supported adjacent its forward end by means of a bearing 61 which is formed in a cover 63 for the casing 52 and engages the sleeve hub 65 of a spool 96 on the shaft 60. At its rear end the drive shaft 60 is supported in a bushing 62 carried in an axial bore in the forward end of the shaft 36. The hand wheel 50 is loosely supported to turn on the sleeve hub of a flanged member 64 keyed to the shaft 60, and is operatively connected therewith by means of an adjustable connection hereinafter more fully to be described. A driving gear 66 is secured to the drive shaft 60, and is arranged to be moved axially therewith into clutching engagement with the internal gear 58 to provide a direct driving connection for the hand wheel 50 and the drive shaft 60 with the driven shaft 36. For driving the shaft 36 at a relatively slow rate from the hand wheel 50, reduction gear connections are provided including a gear 68 having a sleeve hub portion 69 which is supported in a bearing 70 in the casing 52, and is continuously meshed with the gear 66. A sleeve member 71 is fitted within and is slidably secured to the sleeve hub of the gear 68, and is in turn supported upon and rigidly secured to a countershaft 76. A gear 78 formed on the rear end of the countershaft 76 is arranged to be meshed with the slow speed driven gear 56. The countershaft 76 is supported at its forward end by means of a bearing 72 formed in the casing 52 which receives a sleeve member 75 fitted to and secured to move with the countershaft 76. The entire assembly including countershaft 76, sleeve elements 71 and 75 and gear 78 are arranged to be moved axially as a unit to move the gear 78 into and out of clutching position with relation to the gear 56.

In accordance with a feature of the present invention, applicant provides a novel gear shifting device which is constructed and arranged to shift the driving gears 66 and 78 alternatively from inoperative to clutching positions. The gear shifting mechanism is arranged to cause either of the gears 66 and 78 to be shifted into clutching position only after the other of said gears has been moved to its inoperative position, and further provides means for blocking the inoperative gear from movement toward its clutching position while the other of said gears is engaged. Applicant's gear shifting mechanism is also constructed and arranged to cause each of these gears to move a minimum distance to a predetermined inoperative position, the length of movement required to move the gear 66 out of mesh with the relatively narrow internal high speed driven gear 58 being considerably less than that required to move the gear 78 out of mesh with the slow speed driven gear 56. As best shown in Figs. 1, 3 and 5 of the drawings, the gear shifting device comprises a rock shaft 82 which extends transversely of the drive shaft 60 and countershaft 76, and at a point midway between them. The rock shaft 82 is journalled in bearings formed in the casing 52, and at one end is provided with a manual control lever 84 having mounted thereon a detent plunger 86 arranged for engagement alternatively with one of three recesses 88 for locking the lever 84 and rock shaft 82 in three alternative slow, feet and intermediate neutral positions. A pair of rocker arms 89 and 90 are secured to the rock shaft 82, and are arranged to control respectively the positions of the gears 66 and 78. The rocker arm 89 is provided with a segmental end portion 92 for engagement with a groove 94 formed in a spool 96 secured to the drive shaft 60 to move the shaft 60 and gear 66 between its clutching and inoperative positions. The rocker arm 90 is similarly provided with a segmental end portion 98 which is arranged for engagement with a groove 100 formed in a spool 102 fitted to the countershaft 76 between the sleeve elements 71, 75 to move the countershaft assembly including the driving gear 78 into and out of its clutching position with relation to its

slow speed driven gear 56. The right hand side wall of the groove 94 as viewed in the drawings, is provided with a bevelled edge 104 which is so shaped that rocking movement of the rock shaft 82 from the high speed position in a clockwise direction, causes the spool 96 and gear 66 to be moved from the clutching position of Fig. 6 to the inoperative position of Fig. 8 closely adjacent the driven gear 58, and thereafter to cause the segmental end portion 92 of the rocker arm 89 to ride out of the groove 94 against the bevelled edge 104. The length of the segmental end portion 92 is sufficient to maintain the engagement thereof with the bevelled edge 104 while the rock shaft 82 and associated rocker arms 89 and 90 are moved to the alternative slow speed position of Fig. 7, in which the gear 78 is brought into its clutching position with relation to the slow speed driven gear 56. Similarly, the side wall of the groove 100 in the spool 102 is provided with a bevelled edge 106 which is constructed and arranged to cause the segmental end portion 98 of the rocker arm 90 to become disconnected from the groove 100 when the gear 76 has been moved to the inoperative position of Fig. 8 closely adjacent the driven gear 56, continued movement of the rock shaft 82 toward the high speed position of Fig. 6 being effective to move the segmental end portion 98 into locking engagement with the bevelled edge 106. For the intermediate neutral position of the control lever 84 and rock shaft 82, both of the gears 66 and 78 will be located in their inoperative positions. For this position of the parts, as best shown in Fig. 8, the segmental portion 92 of rocker arm 89 and the segmental portion 98 of rocker arm 90 will each have been moved slightly out of their cooperating grooves and into blocking engagement with the respective bevelled edges 104 and 106, thus locking both gears in their inoperative positions to render the hand wheel 50 inoperative to drive the work support.

With the gear shifting mechanism above described, applicant has succeeded in producing a two-speed gear transmission for the hand wheel which is extremely compact in construction, and may therefore be attached to the front side of the machine support without inconvenience to the operator in operating the machine. The construction and mode of operation of the rocker arms and the cooperating grooved spool portions in which the segmental end portions of the rocker arms are disconnected from the groove spool portions and are moved into blocking relation thereto when the respective gears are moved to a predetermined inoperative position, permits of a substantial reduction in the depth of the entire attachment including the casing 52, so that this mechanism may be attached to the front side of the machine support without inconvenience to the operator in running the machine. In order to reduce to a minimum the spacing required between the centers of the drive shaft and countershaft for the insertion of the gear shifting device therebetween, the rocker arms have been constructed of equal length, the difference in length of the shifting movement required to bring the alternate gears into clutching relation being effected through the rotation of the rock shaft 82 by the necessary amount in either direction from its intermediate neutral position.

In accordance with another feature of the invention, means are provided for introducing a lost motion between the hand wheel and the gear driving connections which permits the use of the hand wheel by the operator as a hammer to enable the work table to be moved when so desired by very small amounts. It has been found that a certain amount of lost motion normally exists in the gear driving connections between the hand wheel and the work table. Rotation of the hand wheel acts first to tighten up the driving connections, and then has a tendency to jump the table as the friction of rest of the table on its ways is finally overcome. It has been found that a series of light blows or taps delivered upon the hand wheel gear driving connections will act to overcome this lost motion and also the starting friction of the table to advance the table by the desired small amounts. With the present construction, a lost motion connection is provided between the hand wheel 50 and the flanged sleeve member 64 secured to drive shaft 60, in the form of a stud 110 which is supported on the flanged sleeve member 64 for engagement in a slot 112 in the flanged hub portion of the hand wheel 50. The slot 112 is elongated in a radial direction, the portions towards the axis of rotation of the hand wheel 50 being narrowed to provide a locking fit between the stud 110 and slot 112, and the portion of the slot 112 toward the rim of the hand wheel being widened so that the stud 110, when located in this portion of the slot 112, fits loosely therein, thus permitting a limited amount of lost motion between the hand wheel 50 and the flanged sleeve member 64. In order to permit adjustment of the stud to either of the locking or loose positions and the securing of the stud 110 in its adjusted position, the stud is provided with a flanged portion 114 having opposite sides thereof slabbed off to engage in a radially extending slot 115 in the flanged sleeve member 64, and is further provided with a flange or disk 116 of somewhat larger diameter which rides in a widened groove portion 118 formed at the inner edge of the slot 115 in the flanged sleeve member 64. The stud 110 at its outer end is screw-threaded to receive a knurled headed clamping nut 120. In the position of adjustment shown in Figs. 1 and 2, in which the stud 110 is engaged in the wide portion of its slot 112, the hand wheel 50 is free to move through a small angle with relation to the flanged sleeve member 64, so that the operator is enabled to employ the hand wheel 50 as a hammer to advance the table by very small amounts. For this position of adjustment of the stud 110, it may be assumed that the two-speed gear mechanism will be in the slow speed position illustrated in Fig. 1, in order to increase the efficiency of the two-speed hand wheel in moving the table by very slight amounts.

Certain features of the invention relating specifically to the provision of a lost motion between the hand wheel and the gear driving connections to permit the use of the hand wheel by the operator as a hammer to enable the work table to be moved when so desired by very small amounts, forms the subject-matter of a divisional application for United States Letters Patent Serial No. 498,653, filed August 14, 1943.

It will be understood that the invention is not limited to the specific embodiment shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A gear shifting device for a two-speed transmission having a driving element and two driving gears connected therewith arranged to be shifted alternately from inoperative to engaging

positions, which comprises a pair of rotatable rocker arms connected to turn as a unit, a control element connected to rotate said rocker arms between alternate speed positions of the gear shifting device, gear shifting elements connected respectively to said gears and each having a recess within which the rocker arms are arranged to be engaged respectively, said engaging rocker arms and recesses being so disposed and shaped that movement of the control element and rocker arms from either speed position causes one of said gears to be moved to inoperative position before the other of said gears is moved to the clutching position, and the respective rocker arm to be disconnected from its recess for a predetermined inoperative position of the associated gear to permit continued movement of the control element and rocker arms to the alternate speed position without effecting further movement of said inoperative gear.

2. A gear shifting device for a two-speed transmission having a driving element and two driving gears connected therewith arranged to be shifted alternately from inoperative to engaging positions, which comprises a pair of rotatable rocker arms connected to turn as a unit, a control element connected to rotate said rocker arms between alternate speed positions of the gear shifting device, gear shifting elements connected respectively to said gears and having recessed portions within which the rocker arms are arranged to be engaged respectively, said rocker arms being disposed with relation to one another to cause both of said gears to be held in the inoperative position for an intermediate position of said control element, and each of said recessed portions having a rocker arm engaging wall shaped to cause the engaging rocker arm to become disconnected from said recessed portion in the inoperative position of the associated shifting element and connected gear.

3. A gear shifting device for a two-speed transmission having a driving element and two driving gears connected therewith arranged to be shifted alternately from inoperative to engaging positions, which comprises a pair of rotatable rocker arms connected to turn as a unit, a control element connected to rotate said rocker arms between alternate speed positions of the gear shifting device, gear shifting elements connected respectively to said gears and having recessed portions within which the rocker arms are arranged to be engaged respectively, said rocker arms having segmental recess engaging portions disposed with relation to one another to cause both of said gears to be held in the inoperative position for an intermediate position of said control element, and each of said recessed portions having a rocker arm engaging wall shaped to cause the engaging rocker arm for the inoperative position of the associated shifting element and connected gear to become disconnected from said recessed portion, and the segmental surface of said engaging rocker arm to assume a blocking position with relation to said wall to block movement of the associated shifting element and gear from the inoperative position.

4. A gear shifting device for a two-speed transmission having a driving element and two driving gears connected therewith arranged on parallel axes to be shifted alternately in an axial direction from inoperative to driving positions, which comprises a pair of rocker arms disposed at opposite sides of a common axis to turn as a unit, a control element connected to rotate said rocker arms between alternate speed positions of the gear shifting device, grooved spool portions associated with each of said gears and arranged to be engaged respectively by said rocker arms, said rocker arms being so disposed and the grooved spool portions being so shaped that each rocker arm becomes disconnected from the associated grooved spool portion when said spool portion and associated driving gear has been moved to a predetermined inoperative position.

5. A gear shifting device for a two-speed transmission having a driving element and two driving gears connected therewith arranged on parallel axes to be shifted alternately in an axial direction from inoperative to driving positions, which comprises a pair of rocker arms disposed at opposite sides of a common axis to turn as a unit, a control element connected to rotate said rocker arms between alternate speed positions of the gear shifting device, grooved spool portions associated with each of said gears and arranged to be engaged respectively by said rocker arms, said rocker arms being disposed with relation to one another to cause both gears to be held in inoperative position for an intermediate position of said control element, said rocker arms having segmental groove engaging portions so disposed and each of said grooved spool portions having a side wall thereof so shaped that movement of the control element and rocker arms to either speed position will cause the rocker arm associated with the inoperative spool portion and associated gear to move out of its groove, and the segmental surface thereof to maintain a blocking position with relation to said side wall.

6. A gear shifting device for a two-speed transmission having a driving element and two driving gears connected therewith arranged on parallel axes to be shifted alternately and through unequal distances in an axial direction from an engaging to an inoperative position, which comprises a pair of rocker arms disposed at opposite sides of a common axis transverse to and substantially equi-distant from each of said parallel axes, a control element connected to rotate said rocker arms as a unit between alternate speed positions of the gear shifting device, grooved spool portions associated with each of said gears and arranged to be engaged respectively by said rocker arms, said rocker arms being disposed with relation to one another to cause both gears to be held in the inoperative position for an intermediate position of said control element, each of said grooved spool portions having a side wall thereof shaped to cause the engaging rocker arm for the inoperative position of the associated shifting element and connected gear to become disconnected from said recessed portion and including a bevelled surface for engagement with the end of the rocker arm, and each of said rocker arms having segmental recess engaging portions of which the segmental surface is of sufficient length to maintain engagement thereof with the associated bevel surface during continued movement of the control element and rocker arms to the alternate speed position in which the other of said gears is in the engaging position.

7. A two-speed manual drive device for a machine tool support which comprises with a driven shaft, a slow speed driven gear and a high speed driven element supported thereon, a drive shaft supported co-axially with said driven shaft and a manual drive element connected therewith, a high speed driving gear on said drive shaft axially

shiftable into driving engagement with said high speed driven element, a countershaft, a gear on said countershaft meshing with said high speed gear, and a low speed driving gear on said countershaft axially shiftable into engagement with the slow speed driven gear, and a gear shifting device comprising a shaft extending transversely of and substantially midway between said drive shaft and countershaft arranged to be rocked between high speed and low speed positions, a pair of rocker arms on said rock shaft, and grooved spool portions connected with each of said high speed and low speed driving gears and having the grooved portions thereof arranged to be engaged respectively by said rocker arms, said rocker arms being so disposed and the grooved spool portions being so shaped that each rocker arm becomes disconnected from the associated grooved spool portion when said spool portion and associated driving gear has been moved to its inoperative position.

8. A two-speed manual drive device for a machine tool support which comprises with a driven shaft, a slow speed driven gear and a high speed driven element supported thereon, a drive shaft supported co-axially with said driven shaft and a manual drive element connected therewith, a high speed driving gear on said drive shaft axially shiftable into engagement with said high speed driven element, a countershaft, a gear on said countershaft meshing with said high speed gear, and a low speed driving gear on said countershaft axially shiftable into engagement with the slow speed driven gear, and a gear shifting device comprising a rock shaft extending transversely of and substantially midway between said drive shaft and countershaft arranged to be rocked between high speed and low speed positions, grooved spool portions associated with each of said high speed and slow speed driving gears, a pair of rocker arms on the rock shaft, each having a segmental end portion arranged for engagement with said grooved spool, each of said grooved spools having a side wall thereof so shaped that movement of the rock shaft and rocker arms to shift either gear to the engaging position will cause the rocker arm associated with the alternate spool and associated gear to move out of its groove for a predetermined inoperative position of said alternate spool and gear, and said segmental portions each having the segmental surface thereof of sufficient length to maintain engagement thereof with the side wall of said alternate spool and associated gear during continued movement of the rock shaft and rocker arms to move said first-mentioned gear to the engaging position.

9. In a gear shifting device for a variable speed gear transmission having a plurality of alternative speed positions, the combination of a gear shiftable axially between engaging and inoperative positions, a rock shaft disposed transversely of the gear axis and rotatable in different sectors of operation for effecting different speed positions of said transmission, and connections from said rock shaft operable during rotation of the rock shaft in one of said sectors of operation to shift said gear from an engaging to a predetermined inoperative position including a grooved spool portion connected to be moved as a unit with said gear, and a rocker arm fast on the rock shaft having a segmental groove engaging end portion, the grooved spool portion having a side wall thereof bevelled to cause the segmental surface of the rocker arm to pass out of the groove into blocking relation to said bevelled surface upon the rocking of the shaft into another operating sector.

10. In a two-speed gear driven transmission for manual translation of a machine tool table or the like, a driving shaft and a driven shaft, manual rotating means connected with the driving shaft, an intermediate shaft, transmission gearing connected with all of said shafts including a gear on each of said driving and intermediate shafts shiftable by unequal amounts between engaging and inoperative positions, a gear shifting element having a recess formed therein associated with the shiftable gear on each of the driving and intermediate shafts, and a rocking member comprising a pair of arms of equal length, each engaging one of said recesses, said recesses having arm engaging walls so shaped and the rocking member being so constructed and arranged as to cause said shiftable gears to be moved alternately and by unequal amounts between their engaging and inoperative positions and said arms to ride out of the recesses for said inoperative positions of the gears.

11. In a two-speed gear driven transmission for manual translation of a machine tool table or the like, a driving shaft and a driven shaft, manual rotating means connected with the driving shaft, an intermediate shaft, transmission gearing connected with all of said shafts including a gear on each of said driving and intermediate shafts shiftable between engaging and predetermined inoperative positions, grooved spool portions associated with the shiftable gear on each of the driving and intermediate shafts, a rock shaft extending transversely of and between said driving and intermediate shafts and arranged to be rocked between two speed positions, a pair of rocker arms on the rock shaft, each having a segmental end portion for engagement with one of said grooved spool portions, each of said grooved spool portions having one side wall thereof shaped to cause the associated rocker arm to move out of its grove and the segmental surface theref to ride into blocking relation to said side wall for a predetermined inoperative position of said spool portion and associated gear, and the other side wall thereof shaped to retain the rocker arm in engagement with its groove for the engaging position of the spool portion and associated gear, and thereby to limit rotational movement of the rock shaft and rocker arms in each alternate speed position.

12. A speed changing device for a variable speed transmission having a pair of transmission members arranged for translatory movement in parallel paths alternately between operative and inoperative positions, which comprises for each transmission member an element shiftable as a unit therewith and having a recess formed therein, an oscillatable shifting member having integral arms for engagement in said recesses respectively, said arms having segmental recess engaging portions disposed with relation to one another to cause both of said transmission members to be held in the inoperative position for an intermediate position of said gear shifting member, and each of said recesses having an arm engaging wall shaped to cause the engaging arm for the inoperative position of the associated shifting element and connected transmission member to become disconnected from the recess, and the segmental surface of said engaging arm to assume a blocking position with relation to said wall to block movement of the associated shifting element and transmission member from the inoperative position.

13. A speed changing device for a variable speed transmission having a pair of transmission members arranged for translatory movement in parallel paths alternately between operative and inoperative positions, which comprises for each transmission member a grooved spool portion shiftable as a unit therewith, an oscillatable shifting member supported intermediate said spool portions and having arms disposed at opposite sides of said shifting member for engagement respectively with the grooved spool portions, said arms being so disposed and the grooved spool portions being so shaped that each arm becomes disconnected from the associated grooved spool portion when said spool portion and associated transmission member has been moved to a predetermined inoperative position.

14. A speed changing device for a variable speed transmission having a pair of transmission members arranged for translatory movement in parallel paths alternately between operative and inoperative positions, which comprises for each transmission member an element shiftable as a unit therewith, and having a recess formed therein, an oscillatable shifting member supported intermediate the shiftable elements and comprising a pair of arms of equal length for engaging in said recesses respectively, said arms having recess engaging portions disposed with relation to one another to cause both of said transmission members to be held in the inoperative position for an intermediate position of said gear shifting member, and each of said recesses having an arm engaging wall shaped to cause each engaging arm to become disconnected from its recess for an inoperative position of the associated shifting element which is separately determined for each transmission member.

15. A speed changing device for a variable speed transmission having a pair of transmission members arranged for translatory movement in parallel paths alternately between operative and inoperative positions, which comprises for each transmission member an element shiftable as a unit therewith, and having a recess formed therein, an oscillatable shifting member supported intermediate the shiftable elements and comprising a pair of arms of equal length for engaging in said recesses respectively, said arms having recess engaging portions with segmental surfaces disposed with relation to one another to cause both of said transmission members to be held in the inoperative position for an intermediate position of said gear shifting member, and each of said recesses having an arm engaging wall shaped to cause each engaging arm to become disconnected from its recess for an inoperative position of the associated shifting element which is separately determined for each transmission member, each of said segmental surfaces being of such length to continuously engage the said wall in locking relation thereto during the full extent of angular movement of the shifting member while said associated shifting element is in the inoperative position.

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