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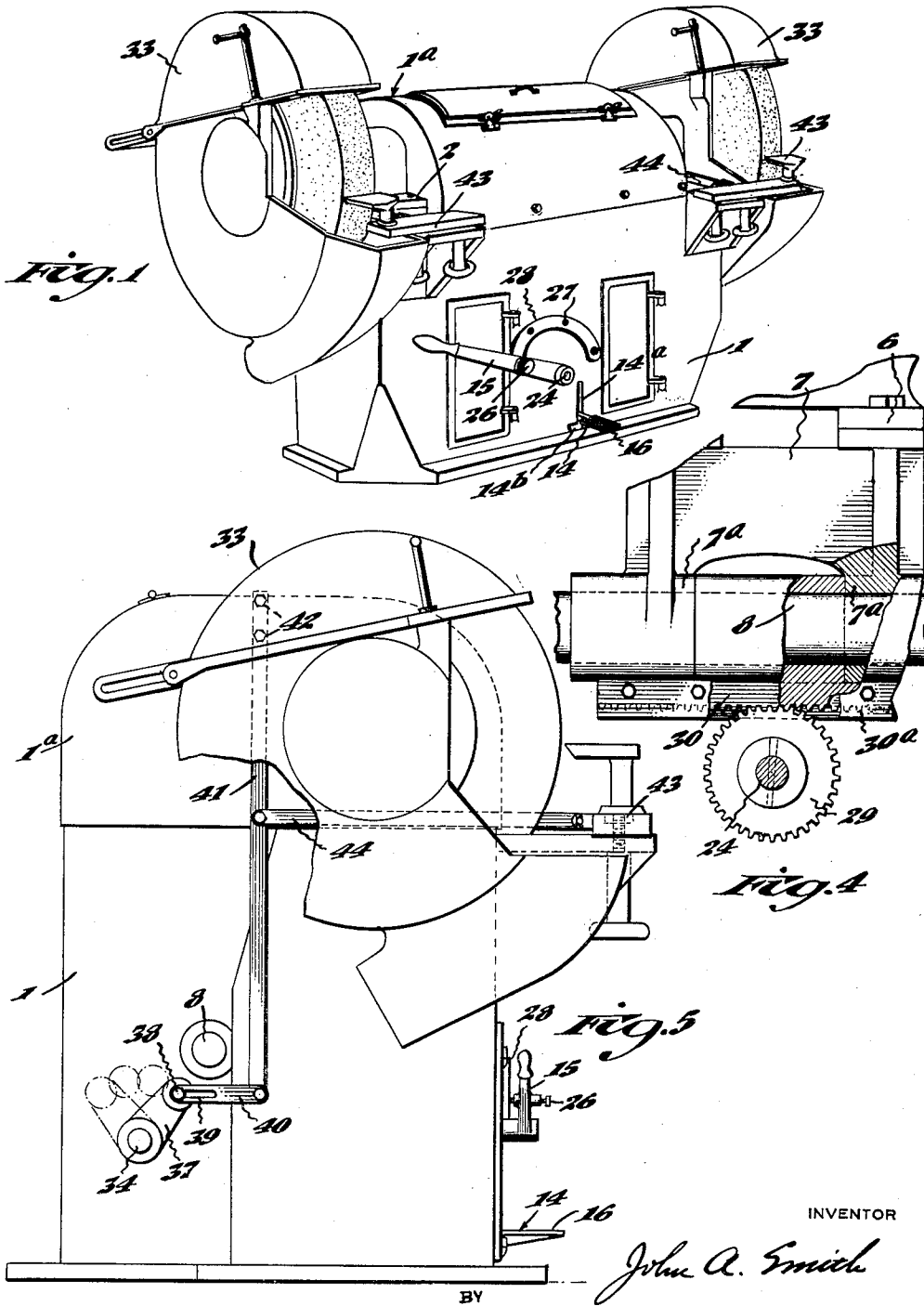
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GRINDING MACHINE

Filed Dec. 4, 1931

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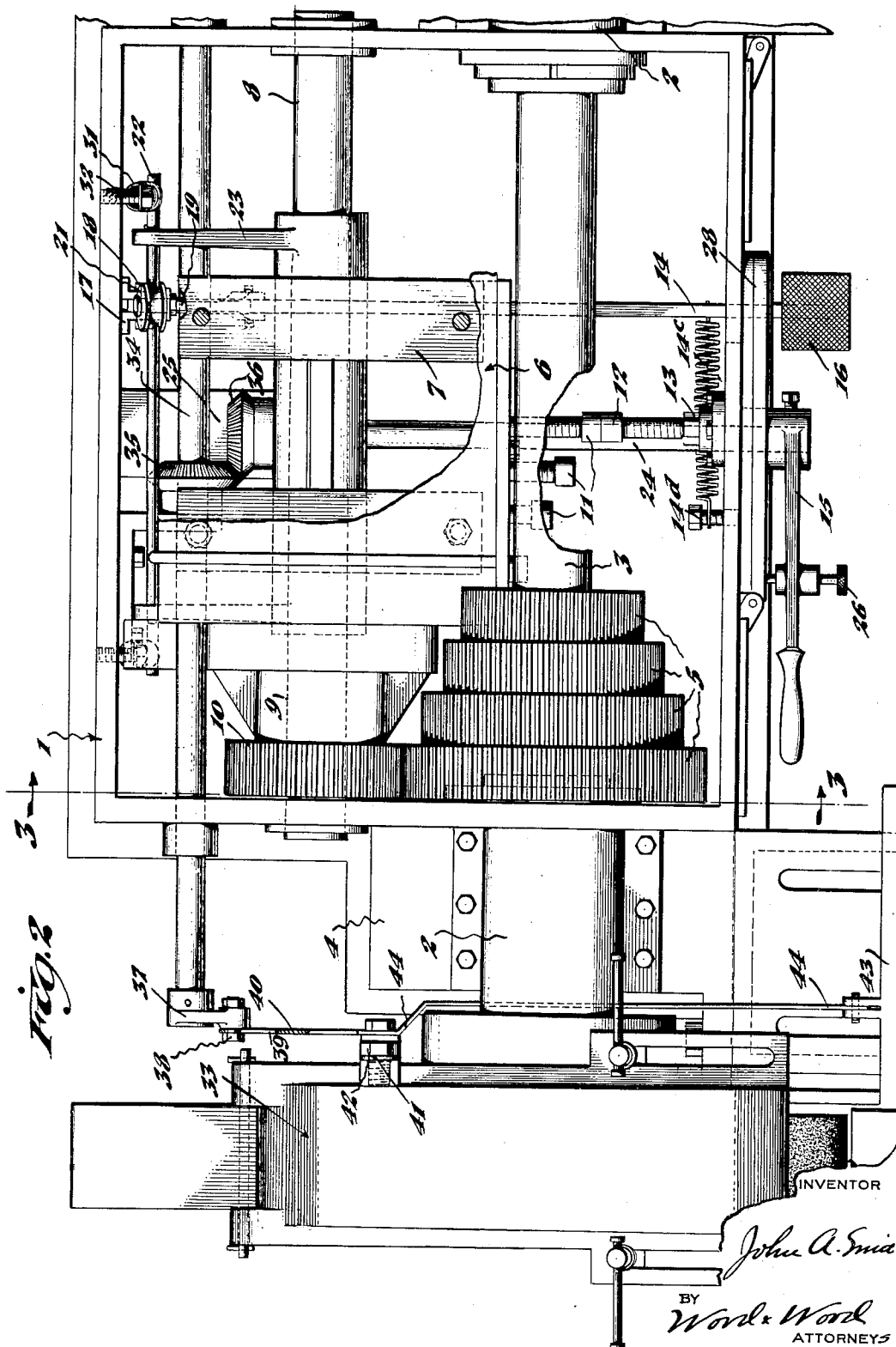
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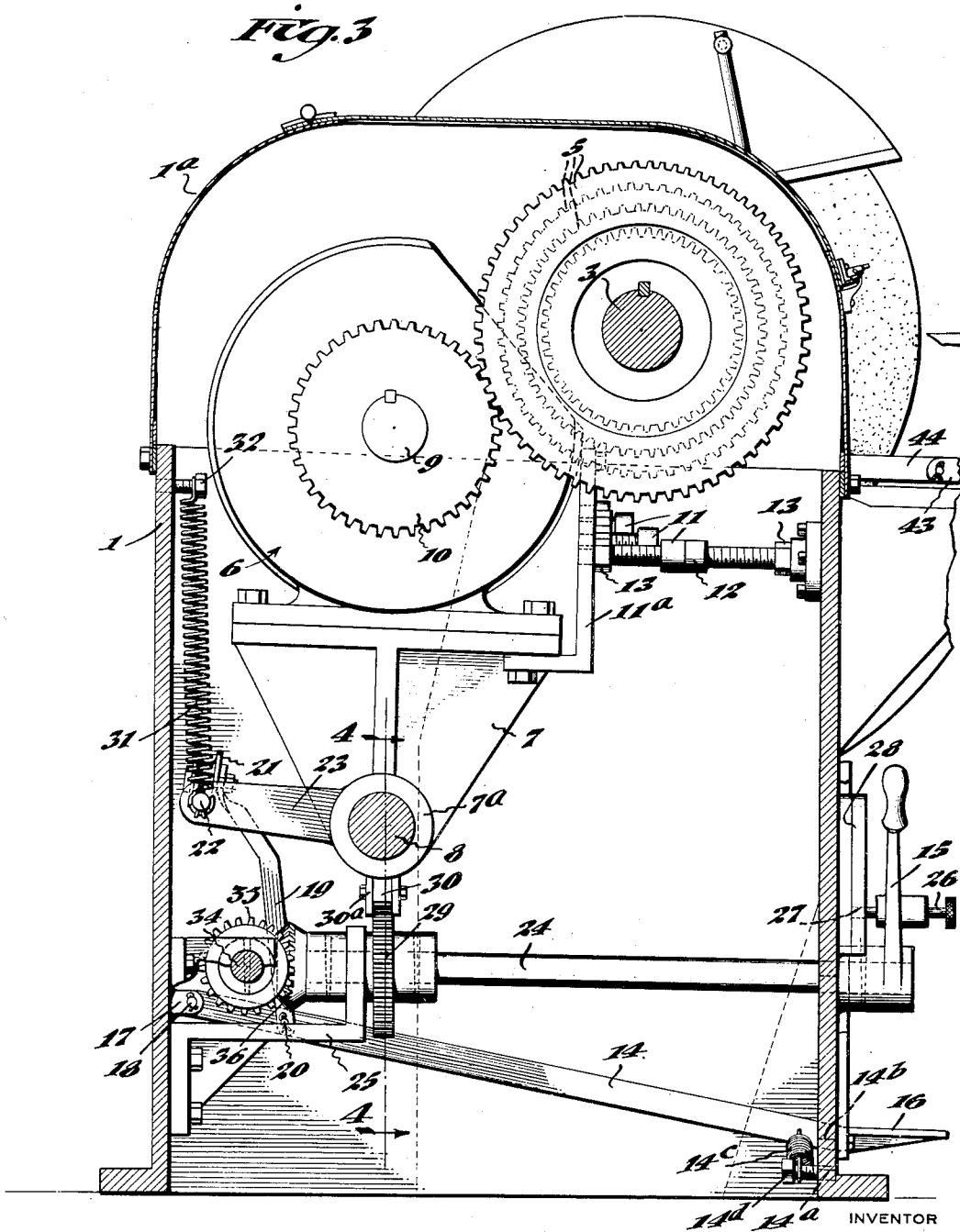
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

1,923,760

GRINDING MACHINE

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Application December 4, 1931. Serial No. 573,853

19 Claims. (Cl. 51-166)

This invention relates to grinding machines and is particularly directed to an improved speed change device and a safety appliance for preventing operation of the grinding wheels at dangerous velocities. The power transmission for this type of machine is arranged for operation of the grinding wheels at speeds proportionate to the diameter of the grinding wheels for the reason that if operated at too great a velocity considering the diameter, the grinding wheels tend to fracture due to centrifugal force and there is the possibility of serious damage. It is, therefore, essential to have variable speeds for the drive shaft to the grinding wheels and to provide that the control for these speeds is dependent on the diameter of the grinding wheels.

It is, therefore, an object of this invention to provide an improved speed change mechanism which is conveniently operable for power operation of the grinding wheels at a variety of speeds and to connect the control or shift means for this speed change mechanism with the guards surrounding the grinding wheels so that higher speed cannot be effected unless the guard in each instance is movable toward the grinding wheel because of reduction in the diameter of the grinding wheel as occurs by wear or otherwise. The guards surround the grinding wheels and as the diameter of the grinding wheel changes due to wear, the guards may be moved toward the same at the forward or working side, this providing a certain clearance in the control connection to the shaft means due to mechanical connection between the guard and the transmission control wherein the transmission control may be manipulated for further change.

It is a further object to provide a gear shifting apparatus which is improved for use in grinding or polishing machines independently of the control imposed by the connection to the guards.

It is a further object to provide an extremely novel mechanical control connection between the guard and the gear shifting apparatus wherein the interlock for compelling speeds proportionate to the diameter of the grinding wheels is effected.

Other objects and certain advantages will be more fully apparent from the description of the accompanying drawings, in which:

Figure 1 is a perspective view of the grinding machine incorporating the present improvements.

Figure 2 is a top plan view with the cover removed, generally illustrating the speed change

mechanism and operating means therefor and the control connection to one of the guards.

Figure 3 is a sectional view taken on line 3-3, Figure 2, further illustrating the speed change apparatus.

Figure 4 is a sectional view taken on line 4-4, Figure 3, illustrating the mounting for the motor and a portion of the gear change operating means.

Figure 5 is an end view of the grinding machine showing the mechanical connection between the speed change operating means and the guard for compulsory proportioning of the grinding wheel speeds relative to the diameter thereof.

The particular style or type of grinder herein illustrated includes a hollow base or machine casing 1 having bearings 2 mounted in alignment at its respective ends. A grinding wheel shaft 3 is mounted in these bearings and extends from the ends of the base or frame, the grinding wheels being fixed thereto at the respective ends. The bearings 2 are separate elements bolted upon ledges or lugs 4 of the grinder frame at the respective ends.

Each grinding wheel includes a sectional guard attached thereabout. A cluster of gears 5 are fixed to the grinding wheel shaft within the frame, these gears varying in size depending on the particular speeds incorporated. The electric motor 6 providing the power for the machine is supported on a base 7 and the motor base is supported for rocking movement on a stationary shaft 8 fixed between the respective end walls of the base toward the rear thereof. The stub shaft 9 of the motor carries a pinion 10 at the end adjacent the gear cluster, this pinion adapted to mesh with any one of the series of gears in the cluster, meshing being accomplished by shifting the motor and its base on the support shaft longitudinally thereof, and rocking or permitting rocking of the motor and base on the shaft to bring the pinion into mesh with the adjacent gear of the series, the speed change therefore depending on the extent of the longitudinal shift.

The centers of the motor support shaft 8, motor stub shaft 9, and grinding wheel drive shaft 3 are so related and the pinion is of a size properly determined relative to the diameter of the largest gear of the cluster whereby mesh between the pinion and any of the gears of the series is maintained by gravity at all times as imposed by the weight of the motor unit, the motor unit being off balance on its support shaft 8, as a pivot, on the side toward the gear cluster. However, for the purpose of preventing meshing of the teeth under the full weight of the motor unit, a series of stops 11 are provided attached to the forward

side of the motor by means of a bracket 11^a, these stops adapted to successively cooperate with a fixed stop 12 attached to the forward wall of the hollow base or machine casing 1.

5 The stops 11 and 12 in each instance consist of screws engaged into the base of the motor or the frame as the case may be and maintained in adjusted position by means of nuts 13. The stop screws on the motor base have their heads
10 disposed at successively greater distances from the frame, the variation in the positions of the heads being determined by the difference of the diameter of the gears on the grinding wheel drive shaft.

15 There are four of these stop screws in this instance, thereby accommodating for four speed change gears 5. As will be apparent from Figure 2, the stop screw protruding the greatest distance from the motor base is in engagement with the stationary stop 12 on the frame at the time
20 when the pinion 10 is in mesh with the largest gear 5 of the cluster. When the motor and pinion have been longitudinally shifted for swinging movement to engagement with the smallest gear
25 of the cluster, the shortest stop screw 11 rests against the stop screw 12 of the frame with the corresponding positions between being apparent from the step relation of the stops 11 as shown in Figure 2 of the drawings.

30 The machine frame includes a cover section 1^a which can be swung back for access to the motor unit and the gears as well as the other operative parts of the gear shifting means.

35 In view of the movements necessary for shifting of the pinion 10 into mesh with a particular gear of the series, there are two control levers provided for this purpose, one of these control levers, namely 14, causing swinging movement
40 of the motor on the stationary rock shaft or releasing the same for swinging movement and the other, namely 15, accomplishing translation of the motor and pinion on the motor support shaft. In the instance of the first control lever 14, the lever extends through an aperture 14^a in the
45 front of the frame and presents a pedal or treadle portion 16 at the front of the machine which the operator may conveniently operate with his foot.

50 The rear end of this treadle lever 14 is pivoted to the back of the frame on a lug 17 thereof by means of a pin 18, and a link 19 is pivoted to the lever 14 by means of a pin 20 forwardly of the rear pivot of the treadle lever. This link carries a roller 21 on its upper end, the roller
55 being loosely rotatably mounted thereon and having its periphery provided with a semicircular peripheral groove after the fashion of a cable roller, this roller engaging upon a stationary rod 22 fixed in and between arms 23 which extend
60 from the motor base radially relative to the axis on which the base rocks. Therefore, as the treadle is depressed a swinging movement is imparted at the motor base and motor by the engagement of the roller 21 with the rod. Due to the length of the rod the motor base is free to
65 be moved longitudinally on its support shaft without disturbing the arrangement of parts for the aforesaid swinging movement.

70 In the instance of the translative means for the motor, the lever 15 is provided at the forward face of the machine adjacent the treadle, this lever being mounted on an operating shaft 24 journaled in the front of the frame and in a bracket 25 affixed to the back of the frame. The control lever is hand operated and is there-
75 fore of considerable length for leverage purposes.

A detent 26 is mounted intermediate the length of the lever 15 and cooperates with a series of apertures 27 arranged in spaced relation in an arcuate or semicircular boss 28 cast on the front of the frame concentrically of the control shaft.

80 A gear 29 is fixed to the control shaft at the front of the rear bracket 25 thereof and is in mesh with a rack 30 slidably mounted on the pivot or motor support shaft 8 between the lugs 7^a of the base 7, the base through this arrangement being
85 rotatable on the shaft 8 relative to the rack 30 and being engaged by the rack for translation thereof in either direction. Plates 30^a are attached to the respective sides of the rack, these plates overhanging the sides of the gear 29 and thereby maintaining the rack against rotation. Therefore, rotation of the control shaft by means of the lever 15 accomplishes translation of the motor and pinion and the apertures and cooperating detent determine the definite positions at which the translative movement is effective for
95 disposing the pinion in the proper meshing alignment with each of the particular gears of the cluster.

100 In performing any one of the series of shifts or speed changes, the operator must first depress the treadle by stepping on the same. The movement of the lever through its connection to the rear end of the motor base rocks the motor unit on its support and moves it from a position of mesh which is slightly forward or out of balance to a position toward the rear where it is substantially balanced, the motor shaft being in vertical alignment with the pivot shaft.

110 Normally when the gears and the pinion are in mesh with any one of the series of gears, the meshed position is maintained by gravity. For assisting the action of gravity, springs 31 are attached between the ends of the rod 22 and bolts or studs 32 fixed to the rear wall of the casing
115 above the rod, these springs acting to swing the motor unit forwardly at all times. The slot 14^a in the forward wall through which the treadle passes, includes a lateral extension 14^b into which the treadle lever may be swung. This lateral slot is positioned so that the lever must be fully depressed but it can be swung into engagement therewith. A spring 14^c attached between a bolt 14^d, on the frame, and the lever pulls the lever 14 toward that side of the slot or aperture 14^a
125 including the lateral slot 14^b at all times so that the lever is immediately drawn into the slot and held there when aligned therewith by full depression of the treadle. This full depression moves the pinion out of mesh with any of the gears and the treadle lever is held in neutral position.

130 With the lever fully depressed, either maintained within the slot by the spring 14^c or held down by foot pressure, the operator then manipulates the hand lever 15 for translating the motor unit on its support rod and accurately positions the pinion by cooperation of the detent in the shift lever with one of the apertures in the wall of the casing. When the given position is attained, the operator then releases the treadle
140 lever and the springs and gravity act to swing the motor unit on its pivot and mesh the pinion with the selected gear, the stops governing or limiting the pressure of gear engagement and causing proper pitch line mesh.

145 The drive of the motor is anticlockwise as viewed in Figure 3 and therefore the thrust of the pinion on the particular gear tends to urge the gears together and stabilizes the gears in meshed position, this preventing any chattering.
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The gear shifting apparatus above described is fully controlled by means of a mechanical connection extending to the grinding wheel guards 33 of the machine. Inasmuch as this mechanical

connection is duplicated at each end of the machine or may be at one end only, its description will be applied to a single end of the machine. For the purpose of the connection, a shaft 34 is mounted in the rear end of the machine longitudinally thereof, this shaft having a bevel gear 35 pinned thereto and in mesh with a bevel gear 36 pinned to the extreme inner end of the operating shaft 24 of the motor unit translating means. The outer end of this longitudinal shaft 34 carries an arm 37 and the upper end of the arm has a bolt or pin 38 therein engaged in the slot 39 of a link 40. The link has the slot thereof disposed toward one end and the opposite end of the link is pivotally attached to the lower end of a rod or bar 41 which is rigidly attached to the guard by a plurality of bolts 42 or other attaching means. To assure uniform resetting movement of the work rest 43 and the guard, a link 44 connects an intermediate point of the fixed bar 41 to the work rest through pin connections. The rest is adjustably mounted at the forward end of the grinding wheel guard for movement toward and from the periphery of the wheel at the point where the guard is open for the application of the work to the grinding wheel.

The particular construction of the guard and the work rest is immaterial to the present case beyond the fact that the parts 41 and 44 may be readily connected thereto for the result that horizontal shifting of the guard and work rest toward and from the grinding wheel is effective for moving the bar fixed thereto and resetting the slotted safety link.

As will be apparent from the end view of the machine, the safety link functions for limiting movement of the arm 37 and the longitudinal shaft 34 and consequently the motor unit translating means. Initially, when the pinion 9 of the motor is in mesh with the largest gear for the lowest speed of the machine, the safety link is maintained in the position shown in the drawings because of the general position of the grinding wheel guard relative to the wheel. As resetting of the guard occurs, the safety link is moved rearwardly sliding on the pin or bolt 38 of the control arm 37 and thereby creating a clearance represented by the traversed portion of the slot. When this clearance is sufficient for permitting enough movement of the linkage and translating means for positioning the pinion adjacent the next gear of the series and consequently increasing the wheel speed, the operator may effect the shift by using the clearance. The position of the guard therefore restrains and controls the shifting operations.

The power transmission and speed change mechanism as set forth comprise a highly efficient form of drive which operates smoothly and in which the gear changes are conveniently made. The interconnection between the guards and the transmission fully and positively prevents the application of improper speeds to the grinding wheel and the operator is assured that the speed at which he is operating is in keeping with the diameter of the grinding wheel.

Having described my invention, I claim:

1. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, a translatable element movable toward and from the periphery of said grinding wheel, speed change gears for said

shaft, a lever for changing gears, a control shaft having a transmission connection with said lever, an arm on said shaft, a link pivoted to said translatable element, said link including a slotted outer end, and a pin carried by said arm translatably engaged in said slot, whereby the position of said pin in said slot controls the movement of said gear shifting lever.

2. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, a gear cluster composed of gears of different sizes fixed to said shaft, a motor unit pivotally and translatively mounted, a pinion driven by said motor unit and carried thereby, means for translating said motor unit for disposing said pinion opposite the particular gear to be meshed therewith, and means for moving the motor unit on its pivot for moving the pinion in and out of mesh with the adjacent gear of the cluster.

3. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, a translatable element movable toward and from the periphery of said grinding wheel, a series of gears of different sizes fixed on said shaft, a power driven pinion adapted to be meshed with any gear of the series, a lever for shifting the pinion into position for mesh, a control shaft having transmission connection with said lever, an arm on said control shaft, a link pivoted to said translatable element, said link including a slotted outer end and a pin carried by said arm translatably engaged in said slot, whereby the position of said pin in said slot controls the movement of said pinion shifting lever.

4. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, a translatable element movable toward and from the periphery of said grinding wheel, a series of gears of different sizes fixed on said shaft, a power driven pinion adapted to be meshed with any gear of the series, a lever for shifting the pinion into position of mesh, and a control means connecting said lever to said translatable element for governing the operation of said lever.

5. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, a gear cluster composed of gears of different sizes fixed to said shaft, a motor unit, a shaft pivotally and translatively mounting said motor unit, a pinion driven by the motor, a rack longitudinally disposed on said motor unit, a gear engaging said rack, a shaft carrying said gear, a lever fixed on said shaft for rotating said shaft and translating said motor unit for disposing said pinion in position opposite a particular one of said gears, means for maintaining said lever in said position, said motor unit pivot shaft disposed relative to the grinding wheel shaft whereby the motor unit is unbalanced toward the gear cluster when the pinion is meshed with any one of the gears, stops limiting gravity induced movement of the motor unit in each of the gear mesh positions for governing the pressure of gear mesh, a rod mounted longitudinally of and on the motor unit at the rear thereof, a roller engaged on said rod, a treadle lever extending to the front of the machine, a link connecting said treadle to said roller whereby depression of the treadle moves the pinion from meshed position, an abutment on the frame of the machine adapted to be engaged by said treadle lever when depressed when the pinion is unmeshed for maintaining the gears in neutral position, and springs nor-

mally urging the motor unit toward the gear cluster.

6. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, gears of different sizes fixed to said shaft, a motor unit, a shaft pivotally and translatively mounting said motor unit, a pinion driven by the motor, a lever and connection for translating said motor unit for disposing said pinion in positions opposite any one of said gears, said motor unit pivot shaft disposed relative to the grinding wheel shaft whereby the motor unit is unbalanced toward the gear cluster when the pinion is meshed with a particular gear, stops limiting gravity induced movement of the motor unit in each of the gear mesh positions for governing the pressure of gear mesh, and a treadle lever and connection to said motor unit, whereby depression of the treadle moves the pinion from meshed position.

7. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, gears of different sizes fixed to said shaft, a motor unit, a shaft pivotally and translatively mounting said motor unit, a pinion driven by the motor, means for translating said motor unit for disposing said pinion in positions opposite any one of said gears, said motor unit pivot shaft disposed relative to the grinding wheel shaft whereby the motor unit is unbalanced toward the gear cluster when the pinion is meshed with a particular gear, and means for swinging the motor unit and pinion away from the gear cluster.

8. In a grinding machine, a shaft, a grinding wheel mounted on said shaft, gears of different sizes fixed to said shaft, a motor unit, a shaft pivotally and translatively mounting said motor

unit, a pinion driven by the motor, means for translating said motor unit for disposing said pinion in positions opposite any one of said gears, means for urging said motor and pinion toward said gears for meshing of the pinion and the particular gear, and means for swinging the motor unit and pinion away from the gear cluster.

9. In a grinding machine, a grinding wheel shaft, a series of gears of different diameters mounted on said shaft, a motor unit including a pinion, a pivotal mounting means for said motor unit, means for rocking said motor unit toward and from said gears for meshing the pinion with a particular gear of the series, and a rack and gear mechanism for translating said motor unit on said pivot shaft, said rack being nonrotatably mounted on the shaft relative to the motor unit and in engagement therewith for movement of the motor unit in the respective directions.

10. In a grinding machine, a grinding wheel, a guard for said grinding wheel, a mounting for said guard whereby the guard is movable toward and from the peripheral surface of the grinding wheel, a speed change transmission for driving said grinding wheel, a lever for shifting the gears of said transmission, a linkage between said lever and said guard, and a free connection in said linkage which prevents shifting of the grinding wheel transmission gears to a higher speed depending on the position of the guard and the linkage to the free connection but permits shifting of the gears in the lower speeds below the particular speed as imposed by the guard and grinding wheel relation.

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