July 4, 1961 J. A. BENKOVICH ET AL 2,990,659

WORK INDEXING MEANS FOR DISC GRINDERS

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Fig 2

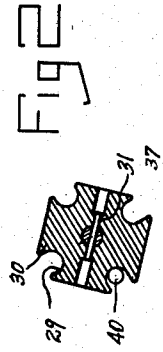


Fig 1

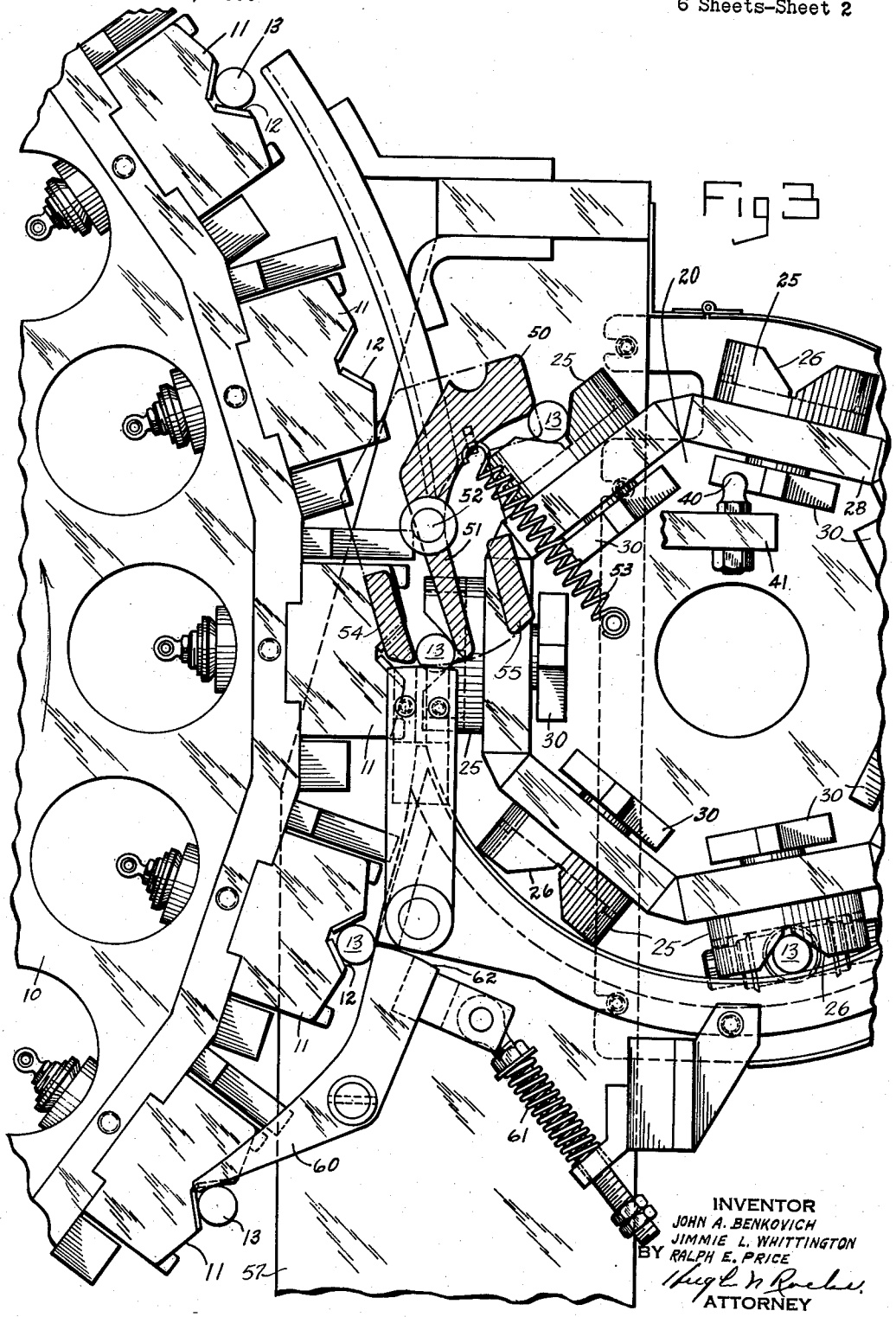
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WORK INDEXING MEANS FOR DISC GRINDERS

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Fig 3



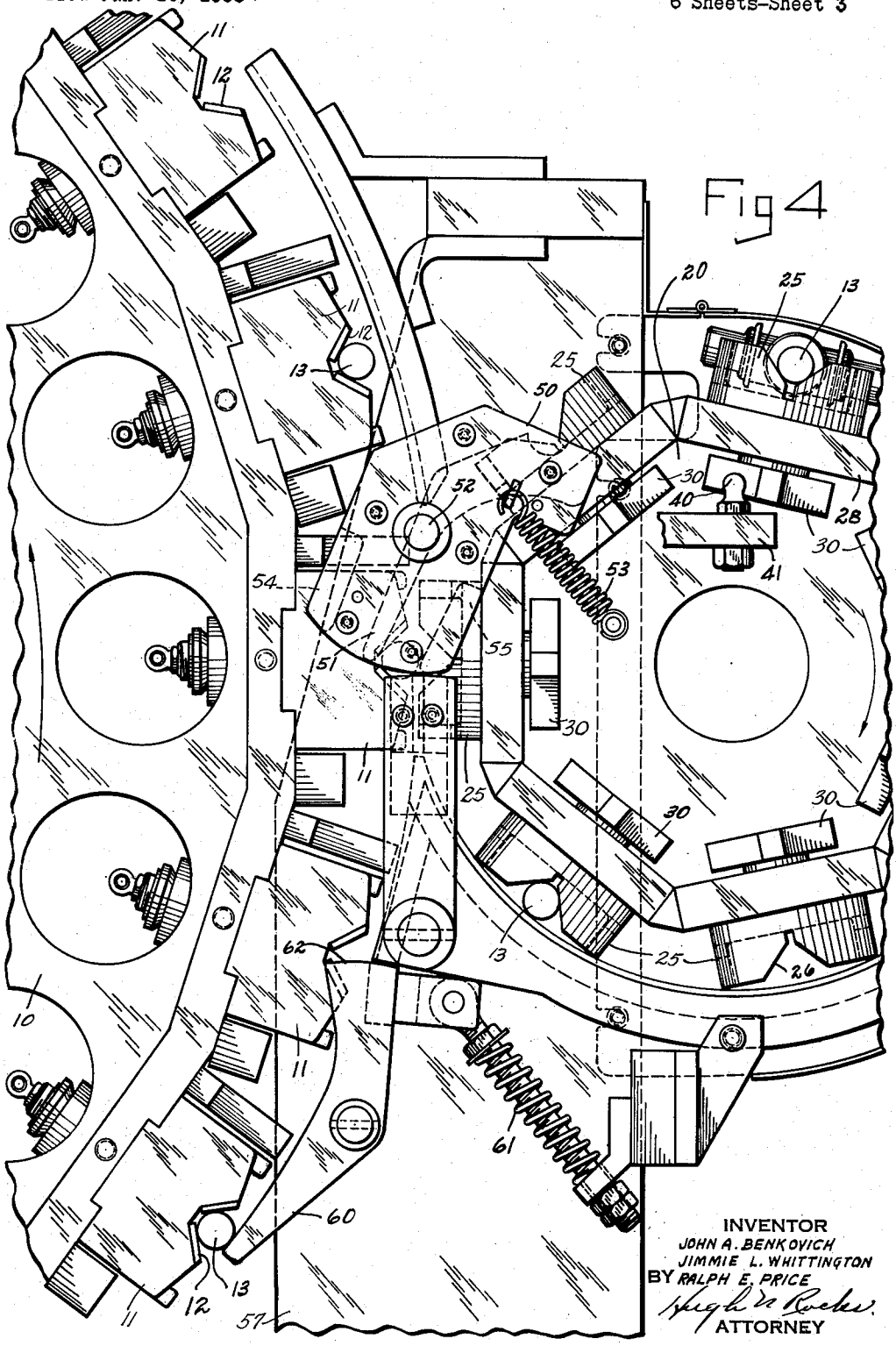
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WORK INDEXING MEANS FOR DISC GRINDERS

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Fig 4



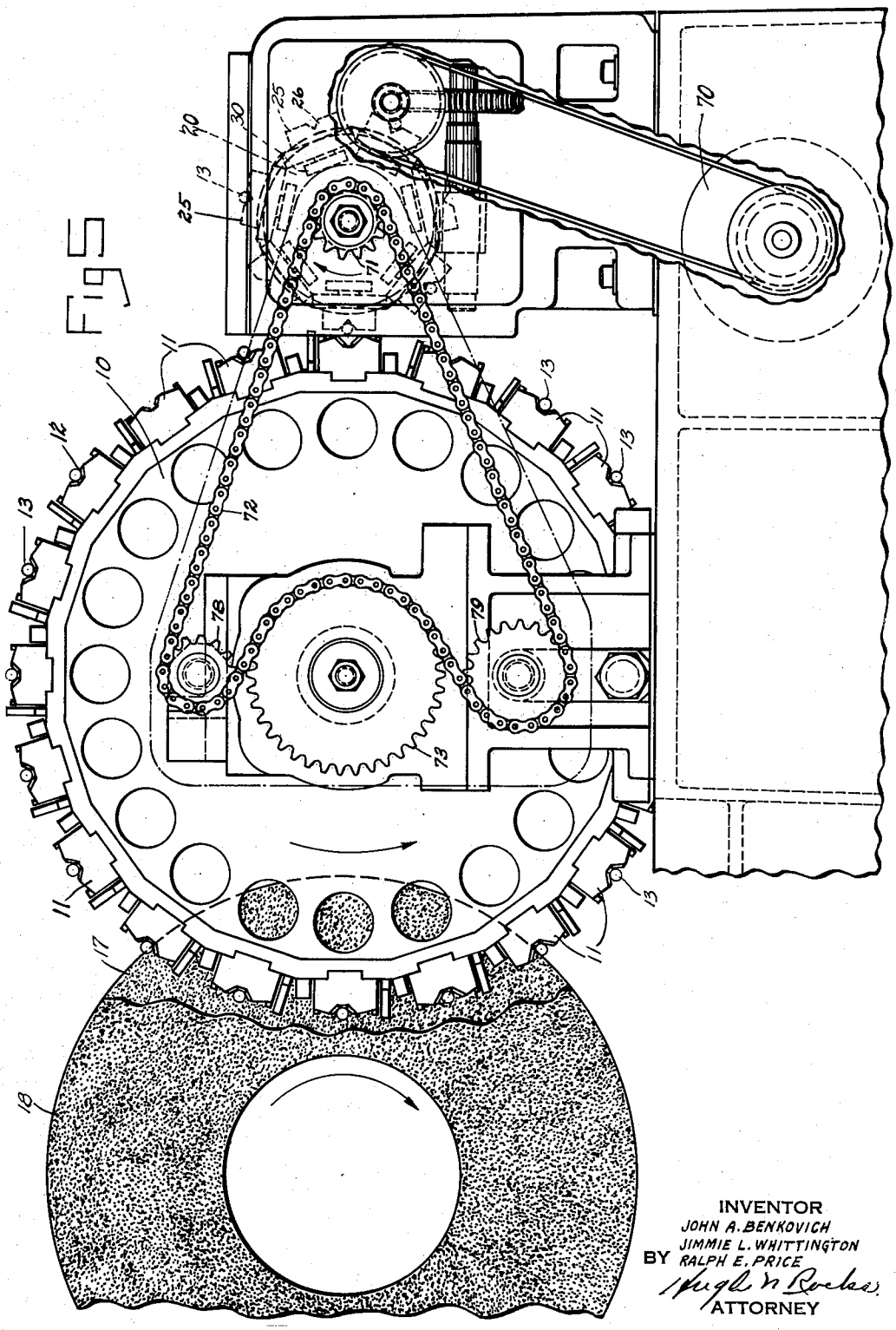
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WORK INDEXING MEANS FOR DISC GRINDERS

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Fig 5



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WORK INDEXING MEANS FOR DISC GRINDERS

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Fig 1

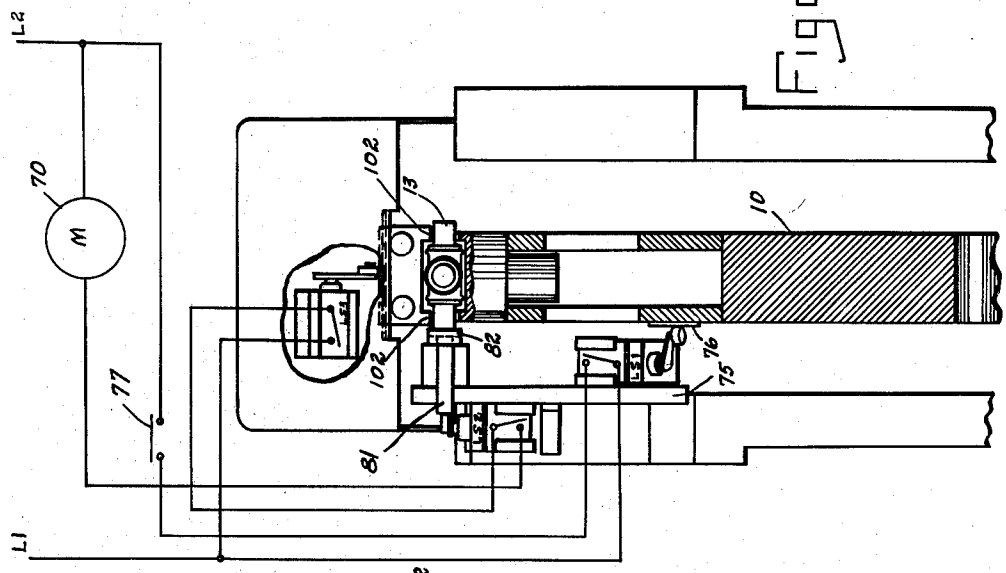


Fig 7

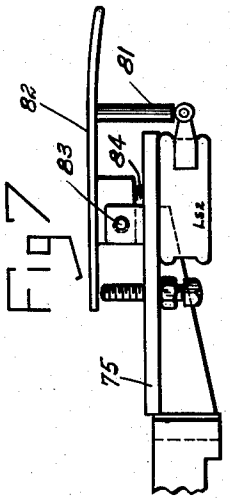
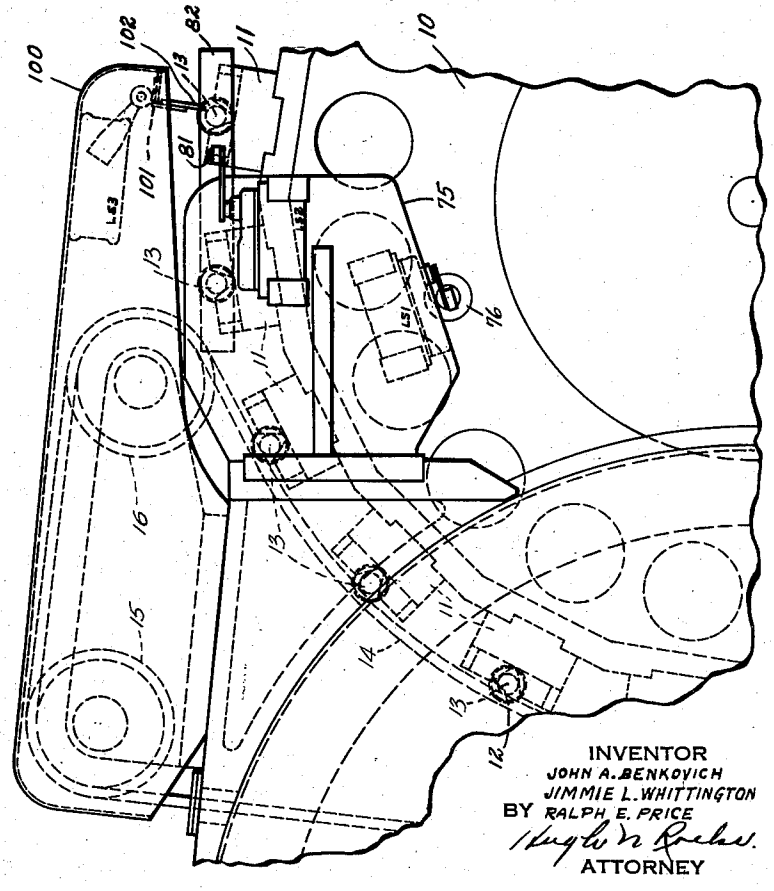


Fig 6



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WORK INDEXING MEANS FOR DISC GRINDERS

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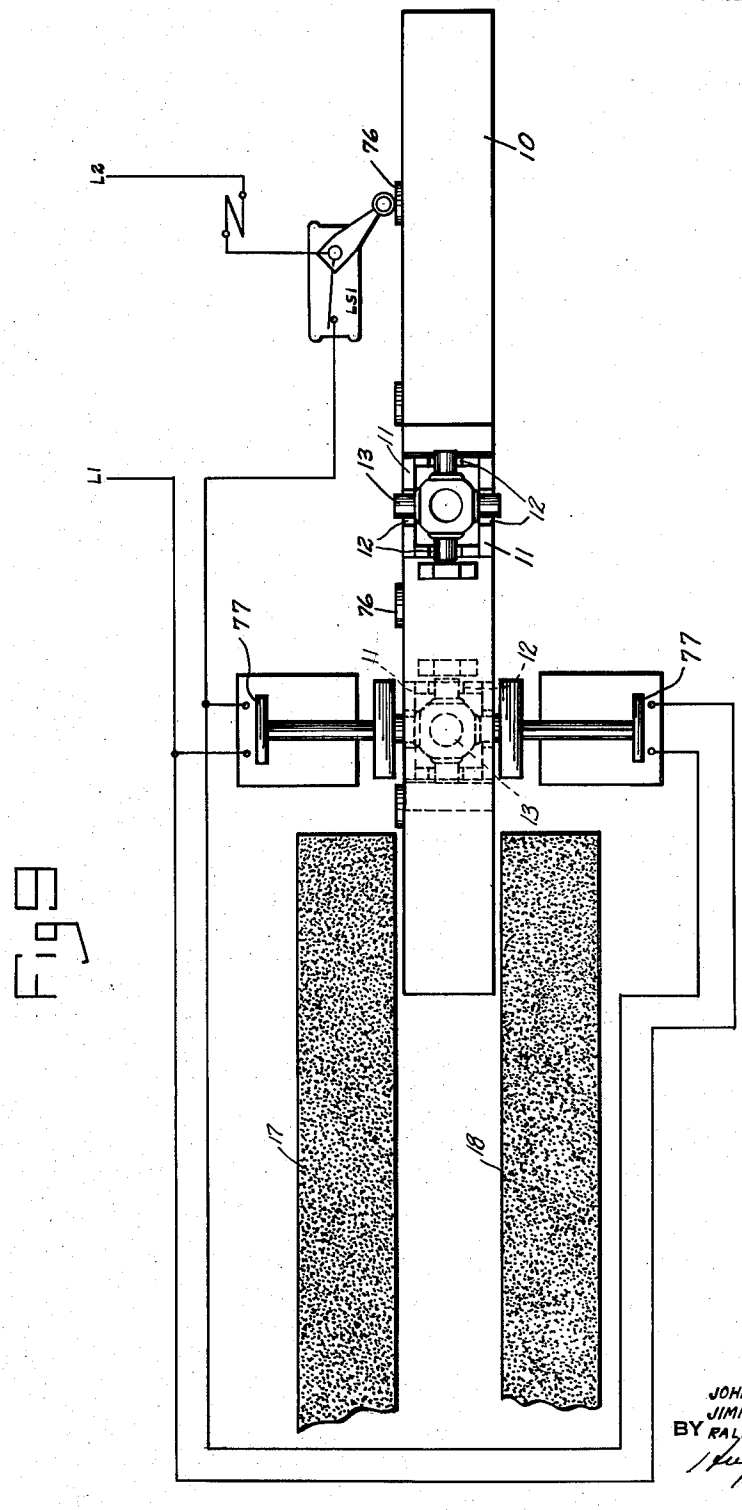


Fig. 5

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2,990,659

WORK INDEXING MEANS FOR DISC GRINDERS

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Filed Jan. 16, 1958, Ser. No. 709,408
7 Claims. (Cl. 51—118)

This invention relates to surface grinders of the type known as disc grinders for grinding opposed parallel sides of workpieces.

In order to grind workpieces having two or more sets of parallel sides or ends, it is necessary to index the workpieces to change from the position for grinding one pair of parallel sides or ends, to position for grinding another pair of parallel sides or ends. The usual way of effecting such indexing is for the operator to remove the piece from the carrier after the first pair of parallel sides have been ground, turn the work 90° and replace it in the carrier in position to grind the second pair of parallel sides. It is possible to provide automatic indexing where the work holder in the carrier may be indexed. However, there are a number of serious disadvantages involved in indexing in this manner.

It is therefore an object of this invention to provide means operable in timed relation to the movement of the carrier to remove a workpiece from the carrier after one pair of opposed parallel sides has been ground, turning the workpiece to a position to present the next pair of opposed parallel sides for grinding and return the workpiece in this position to the carrier.

Another object is to provide means operable by engagement with a moving workpiece to remove a subsequent workpiece from the work holder.

Another object is to provide means whereby one workpiece is transferred from the carrier to the indexer, said means being effective alternately to transfer an indexed workpiece to the carrier.

Another object is to provide means for discharging alternate workpieces from the carrier and for retaining other alternate workpieces in said carrier.

FIGURE 1 is a partial end elevation showing the relation between the work carrier and the indexer.

FIGURE 2 is a section on the line A—A of FIGURE 1 showing the means for effecting the index movement.

FIGURE 3 is an enlarged partial end elevation showing the work transfer fingers in one position.

FIGURE 4 is an enlarged partial end elevation showing the work transfer fingers in another position.

FIGURE 5 is an end elevation showing the means for driving the carrier and the indexer.

FIGURE 6 is a partial end elevation showing the location of certain limit switches which co-operate with the carrier.

FIGURE 7 is a partial plan view showing the mounting of one of said limit switches.

FIGURE 8 is a combination front elevation and electrical diagram showing the relation between said limit switches and the parts which they control.

FIGURE 9 is a digaramatic plan view showing the positions of the gage contacts.

Numeral 10 indicates a work carrier for a double disc grinding machine having opposed, rotatable abrasive discs 17 and 18. Work carrier 10 has distributed about its periphery an even number of work holding fixtures 11, each having a V-notch 12 for receiving a workpiece, such as a universal joint spider 13. Workpieces 13 are held in fixtures 11 by belt 14 carried on pulleys 15 and 16 at the upper position, passing over the workpieces on carrier 10 to the point of discharge at the lower end of carrier 10 from which they pass over another set of pulleys (not shown), but identical with pulleys 15 and 16.

Means for indexing said universal joint spider 13 to present a second pair of parallel faces for grinding consists of a rotatable member 20 peripherally opposed to work carrier 10 and rotated synchronously with work carrier 10 by means which will be described later. Said indexing member 20 consists of a series of work holding fixtures, un-even in number, peripherally spaced about indexing member 20. Each of said work holding fixtures consists of a rotatable work holding member 25 having suitable notches 26 to receive a workpiece such as a universal joint spider. With an even number fixtures 11 on carrier 10 and an un-even number of fixtures 25 on indexer 20, a given indexer fixture will match with the even-numbered fixtures on carrier 10 during one revolution of carrier 10 and with the odd-numbered fixtures during the next revolution of carrier 10.

As the carrier work fixtures 11 pass through the transfer point, the fixture carrying a half-finished workpiece will release the workpiece to the indexer. The next carrier work fixture which should be empty will receive an indexed, half-finished workpiece from the indexer.

Work holding member 25 has an integral stub shaft portion 27 journaled on a support member 28. A reduced portion 29 of stub shaft portion 27 extends beyond the support member 28 and has an index wheel 30 attached thereto by means of pin 31.

A ball 35 is urged by spring 36 into engagemnet with a depression 37 in the underside of work holding member 25 to locate said work holding member 25 to properly align a workpiece in the indexed position for transfer back into the grinding fixtures 11 of work carrier 10. A spherical member 40 is supported on bracket 41 in position to engage the index wheel 30 and rotate the work holding fixture to position the unground surfaces of workpieces 13 for grinding as it passes by said spherical member 40.

Work carrier 10 and index member 20 are rotated at such a rate that the notches 26 in the work holding members 25 coincide with the notches 12 on the work holding fixtures 11 in work carrier 10 at the point of transfer from carrier 10 to indexer 20 and vice-versa.

The means for transferring a workpiece from a work holding fixture 11 in work carrier 10 to a work holding member in index member 20 consists of axially spaced members 50 having central finger-like portions 51 for engaging each of a pair of axially spaced journals on workpiece 13. On either side of fingers 51 and in spaced relation thereto are guide portions 54 and 55.

Member 50 is pivotally mounted at 52 on a pair of spaced support members 56 at the left and 57 at the right and is urged in a clockwise direction by means of spring 53. Member 50 is positioned on said support members 56 and 57 at a point above the transfer point. In this position, FIG. 4, fingers 51 are held to the left of the workpiece in the carrier work holding fixture 11. As the work carrier 10 and index member 20 move upwardly, fingers 51 and guides 55 remove the workpiece out of carrier work holding fixture 11 and into indexer work holding member 25. As the work holding member 25 and workpiece 13 approach the upper end of member 50, said member 50 is urged in a counter-clockwise direction by workpiece 13, and the lower portion of fingers 51 are positioned to the right of workpiece 13 in the next work holding member 25 in index member 20.

As the work carrier 10 and index member 20 rotate together, workpiece 13 rides along the left hand side of fingers 51 between said fingers 51 and guides 54, and as another workpiece 13 moves from under the upper end of member 50, spring 53 rotates member 50 in a clockwise direction and fingers 51 urge workpiece 13 out of index fixture 25 and into the work carrier work holding fixture 11.

As the indexer work fixture 25 carrying a workpiece 13, passes the end of fingers 50, the index wheel 30 attached to indexer work fixture 25 is engaged by spherical member 40 and rotated through an angle sufficient to place the next two parallel surfaces of the workpiece in position for grinding. In this case, the angular movement is 90°.

In order to discharge finished workpieces 13 from the work carrier 10 and permit half-ground workpieces to remain in the work carrier 10 to be transferred to the index member 20, a pair of fingers 60 pivotally mounted in support members 56 and 57 below the transfer point, are urged in a counter-clockwise direction by means of spring 61. Movement of said fingers 60 in a counter-clockwise direction is limited by a workpiece 13 in one of the work holding fixtures 11. When so limited, the lower ends of fingers 60 are held in a position, such that a workpiece 13 in the next work holding fixture 11 is ejected by fingers 60. When the workpiece in the first mentioned work holding fixture 11 passes both the upper ends 62 of fingers 60 and releases spring 61, the fingers 60 are then shifted in a counter-clockwise direction to a position to engage the right hand side of workpiece 13 and hold it in the work holding fixture 11 so that it may be transferred to the indexer, indexed and transferred back into another work holding fixture 11 for the second grinding operation.

Means for driving work carrier 10 and index member 20 consists of a motor 70 connected through suitable gearing to drive index member 20. A sprocket 71 on index member 20 is connected through a chain 72 and a pair of vertically spaced sprockets 78 and 79 between which the chain 72 makes a reverse path about sprocket 73 on work carrier 10. The ratio between sprocket 71 on index member 20 and sprocket 73 on work carrier 10 is such that the work holding members on each member 10 and 20 coincide or mate at the point of transfer.

Limit switch LS1 is mounted on bracket 75 in position to engage a series of pads 76 angularly spaced about one side of work carrier 10. Limit switch LS1 is connected in series with a gauge contact 77. The position of limit switch LS1 with relation to work carrier 10 and gauge contact 77 is such that when workpiece 13 is passing through the gauge, limit switch LS1 is actuated by one of the pads 76 and the gauge circuit is operative only at this time. Under certain circumstances, it may be desirable to prevent the rotation of the work carrier 10 or index member 20.

As indicated above, each workpiece must be carried through the grinding zone by the carrier, removed from the carrier, indexed and returned to the carrier to make a second pass through the grinding zone. This means that when a workpiece on the carrier reaches the discharge point, it must either be removed from the carrier or retained in the carrier to be later removed by the indexer.

The angular position of the fingers which remove or retain the workpieces in the carrier as well as the fingers which guide the workpieces from the carrier to the indexer and from the indexer to the carrier, is determined by the presence or absence of a workpiece in the carrier or indexer.

Since the workpieces in the carrier at the discharge point are alternately finished or half-finished, and since the finished piece must be discharged, the operation of the finger 60 and also finger 50 is alternately determined by an empty work holder or a work holder having a workpiece in it. The empty carrier work holder then receives a half-ground and indexed workpiece from the indexer. The empty index work holder permits finger 60 to be held by its spring in its clockwise position so that a workpiece will be transferred from the next holder on the carrier to the next holder on the indexer. Thus, the operation of the carrier and indexer is dependent on the proper disposition of the finished and half-finished workpieces. If a carrier work holder were allowed to pass through the discharge point empty, it would cause fingers 60 and 50 to function in such a manner as to remove half-ground workpieces and cause the finished workpieces to again be subjected to the grinding operation.

Limit switch LS2 is mounted on bracket 75 for operation in a horizontal plane. The arm of limit switch LS2 rests on projection 81 on a work engaging shoe 82 which is pivotally mounted at 83 on bracket 75 and held against workpiece 13 by spring 84. So long as there is a workpiece in each work holding fixture, shoe 82 will be held in position to close limit switch LS2. If an empty work holding fixture 11 attempts to pass shoe 82, spring 84 will urge shoe 82 to a position to release limit switch LS2 and open the circuit to motor 70.

In the cover 100 is mounted a limit switch LS3, to which is hinged a feeler member 101 which rests upon a ledge inside cover 100. LS3 is in series with LS2. Feeler member 101 includes an adjustable bar having a pair of fingers 102 thereon, spaced to coincide with the journals on a workpiece 13. If workpiece 13 is not solidly positioned in the work holding fixture 11, it will engage fingers 102 and actuate limit switch LS3 to open the circuit to motor 70. Switches LS2 and LS3 are in series so that both must be closed to keep motor 70 in operation.

We claim:

1. In a disc grinder for grinding pairs of parallel sides or ends of workpieces, rotatable abrasive discs having opposed operative surfaces, a rotatable work carrier for carrying workpieces between said operative surfaces, peripherally spaced work holders on said work carrier, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on each workpiece comprising a rotatable indexer mounted in peripherally opposed relation to said work carrier and having peripherally spaced work holders thereon, means for rotating said work carrier and said indexer in predetermined timed relation so that the work holders on said carrier and said indexer are in matching relation at the point at which they approach most closely, selective means for removing finished workpieces from said work carrier and for retaining partly finished workpieces in said work carrier comprising a finger pivotally mounted in fixed relation to said carrier and said indexer and normally held yieldingly in position to retain a workpiece in said work holder, said finger having an upper portion operable in response to movement of a workpiece in said indexer to shift the lower end of said finger to a position to remove a finished workpiece from said work carrier in response to the movement of said partly finished workpiece in said indexer.

2. In a disc grinder for grinding pairs of parallel sides or ends of workpieces, rotatable abrasive discs having opposed operative surfaces, a rotatable work carrier for carrying workpieces between said operative surfaces, an even number of peripherally spaced work holders on said work carrier, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on each workpiece comprising an indexer mounted in peripherally opposed relation to said work carrier and having an un-even number of peripherally spaced work holders thereon, means for rotating said work carrier and said indexer in predetermined timed relation, means for transferring workpieces from said work carrier to said indexer including a pivoted finger normally resiliently urged in a direction toward a position to hold workpieces in said carrier work holder after the first pair of parallel surfaces have been ground, said finger being shaped so that when a workpiece engages the upper end thereof, said finger will be rotated in a clockwise direction to a position on the opposite side of the next workpiece so that the movement of said first workpiece along said next finger will be effective to remove said workpiece from said work carrier to said indexer.

3. In a disc grinder for grinding pairs of parallel sides

or ends of a workpiece, rotatable abrasive discs having opposed operative surfaces, a work carrier rotatably mounted for carrying workpieces between said operative surfaces, peripherally spaced work holders on said work carrier, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on the workpiece comprising an indexer rotatably mounted in peripherally opposed relation to said work carrier and having peripherally spaced work holders rotatably mounted thereon, means for rotating said work carrier and said indexer in predetermined timed relation, means operable in response to the rotation of said work carrier and said indexer for transferring workpieces from said work carrier to said indexer, means responsive to rotation of said indexer to turn a work holder to place a second pair of parallel sides in position to be ground, and means for thereafter transferring said workpieces back to said work carrier.

4. In a disc grinder for grinding pairs of parallel sides or ends of a workpiece, rotatable abrasive discs having opposed operative surfaces, a work carrier for carrying workpieces between said operative surfaces, peripherally spaced work holders on said work carrier, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on the workpiece comprising an indexer mounted in peripherally opposed relation to said work carrier and having peripherally spaced work holders thereon, means for rotating said work carrier and said indexer in predetermined timed relation, means for transferring workpieces from said work carrier to said indexer including a finger, and means for resiliently holding said finger in position to retain a workpiece in said work carrier after it has been ground.

5. In a disc grinder for grinding pairs of parallel faces of a workpiece, rotatable abrasive discs having opposed operative surfaces, a rotatable work carrier for carrying workpieces between said operative surfaces, peripherally spaced work holders on said work carrier, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on each workpiece including a rotatable indexing device mounted tangentially of said carrier, work transfer means intermediate the carrier and the indexing device, for transferring workpieces from said work carrier to said indexing device, means on said indexing device for turning said workpiece to position the second pair of parallel sides for grinding, means on the transfer means for thereafter transferring said workpiece from said indexing device to said work carrier, and means

for actuating said work carrier and said indexing device simultaneously.

6. In a disc grinder for grinding pairs of parallel faces of a rotatable workpiece, rotatable abrasive discs having opposed, operative surfaces, a work carrier for carrying workpieces between said operative surfaces, peripherally spaced work holders on said work carrier, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on each workpiece including a rotatable indexing device mounted tangentially of said carrier, work transfer means intermediate the carrier and the indexing device, for transferring workpieces from said work carrier to said indexing device, means on said indexing device for turning said workpiece to position the second pair of parallel sides for grinding comprising a work holder, an indexing wheel on said work holder, and means to engage and rotate said index wheel and said work holder into position opposite the transfer means to replace the workpiece on the carrier with the unground portions of a workpiece in position to be ground.

7. In a disc grinder for grinding pairs of parallel sides and ends of workpieces, having two rotatable abrasive discs with opposed operating surfaces, a rotatable work carrier member for carrying workpieces between said discs, means for repositioning workpieces in said work carrier to grind a second pair of parallel sides on each workpiece comprising a rotatable work indexer member mounted in peripherally opposed relation to said work carrier on an axis parallel to that of the work carrier, one of said members having an even number of work holders thereon, the other member having an uneven number of work holders, means for rotating said two members at the same peripheral speed, means associated with said indexer member for angularly indexing said work holders on the indexer member, and means for transferring alternate workpieces between said work carrier and said indexer member.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 24,104	Robbins	Dec. 27, 1955
1,923,931	Jones	Aug. 22, 1933
1,939,038	Bower et al.	Dec. 12, 1933
2,128,186	Jones	Aug. 23, 1938
2,404,648	Meyerhoff	July 23, 1946
2,779,956	Butler et al.	Feb. 5, 1957
2,809,471	Jones	Oct. 15, 1957