June 7, 1955 R. M. MANNING 2,709,923

GEAR TRAIN MECHANISM

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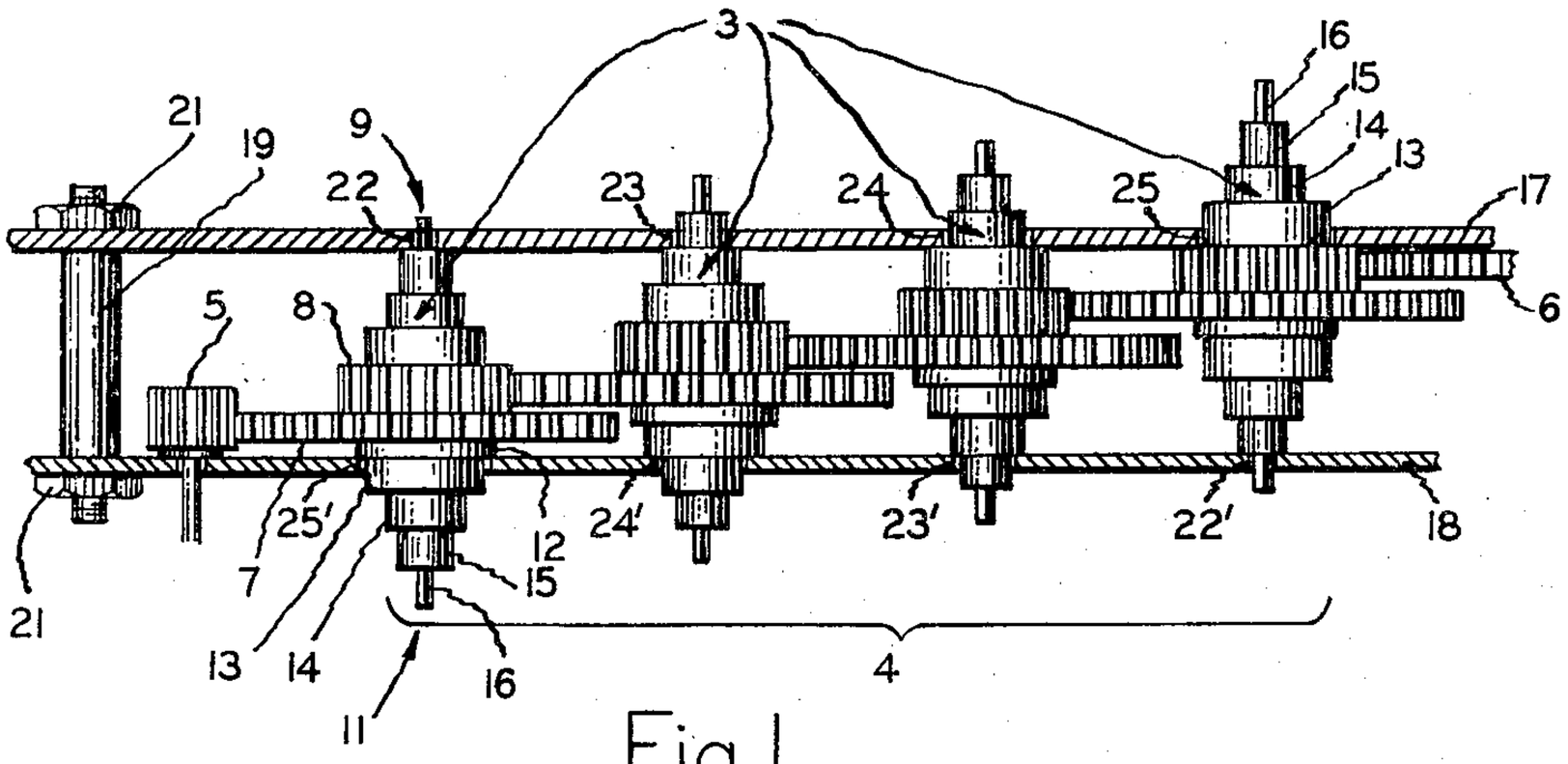

Fig. 1

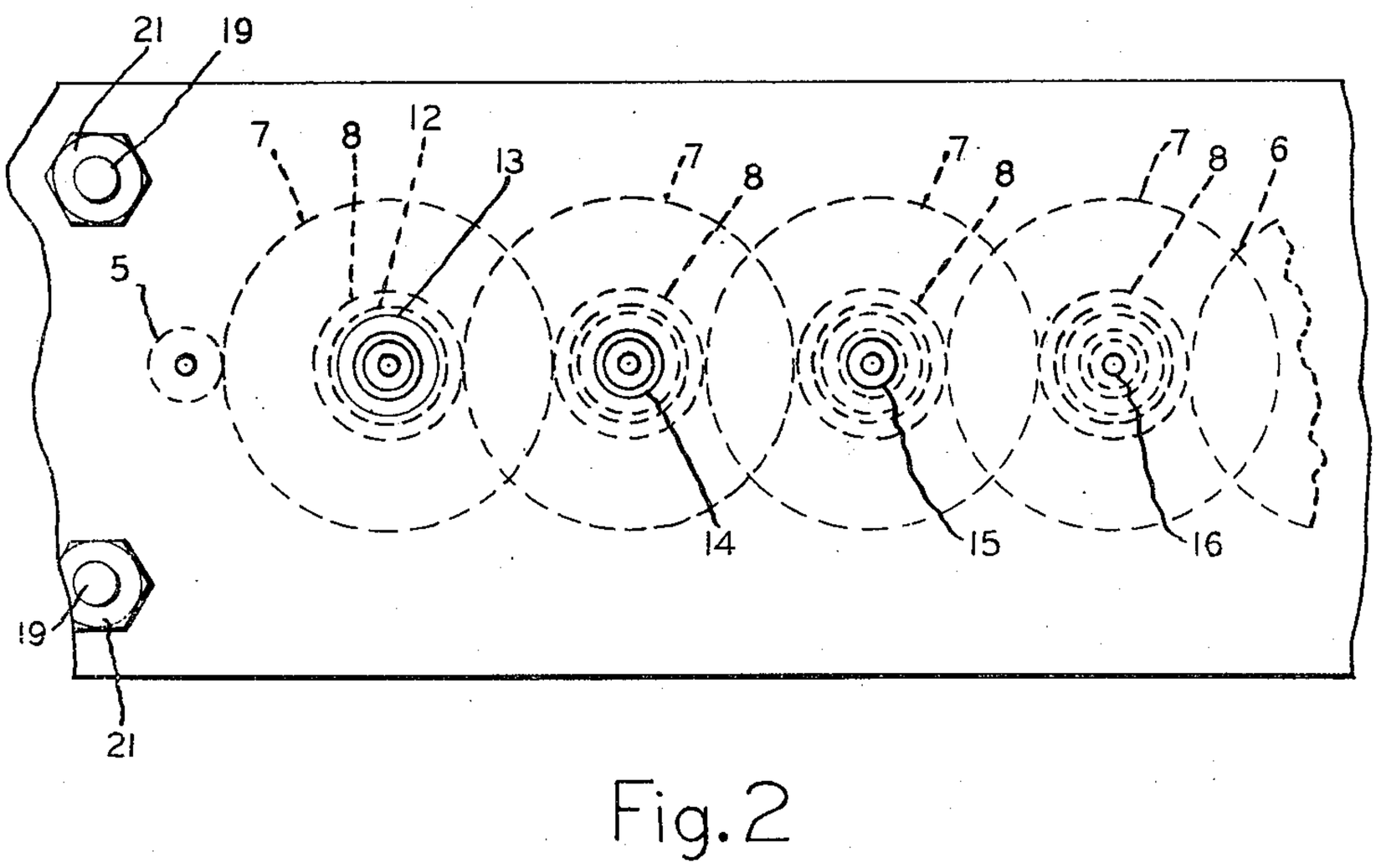

Fig. 2

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GEAR TRAIN MECHANISM

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This invention relates to improvements in gear train mechanisms and has for its principal object the provision of a simplified design permitting greater economy of manufacture than has heretofore been possible with such mechanisms.

Briefly, the invention comprises a plurality of intermeshing gear assemblies, each assembly of which includes a pair of gears of different diameters mounted for rotation between a pair of spaced members. All of the gear assemblies are alike and each has identical shaft portions embodying a novel step-like configuration cooperating with suitable apertures provided in the mounting members. The apertures range in diameter so that each receives a different portion of the shaft therein whereby individual pairs of gears are located at successively greater distances from one of the spaced mounting members, or at successively smaller distances from the other mounting member, depending of course upon which is selected as a reference. In this way, the necessary lateral spacing is achieved to permit proper intermeshing of the gears and at the same time provide adequate clearances for proper operation.

Since all gear assemblies are identical, it is possible to lower manufacturing costs through greater availability of mass production techniques, the reduction in tool costs, the ease of assembly, and the possibility of substantially reduced inventories of spare and replacement parts.

The invention, its objects and the benefits and advantages to be derived therefrom, will be best understood upon reference to the detailed description set forth below, particularly when taken in conjunction with the sheet of drawings annexed hereto, in which Fig. 1 is a top-view, partly in section, of the novel gear train covered hereby, and Fig. 2 is a fragmentary view, in elevation, of the arrangement shown in Fig. 1. In both Figs 1 and 2, the views show the mounting means in addition to the gear assemblies.

Referring first to Fig. 1, wherein like parts will be assigned like numbers, we see a plurality of intermeshing gear assemblies **3** forming the gear train **4** by which motion imparted to the driving pinion **5** can be transmitted and reduced to the driven gear, a portion of which is shown at **6**. In the embodiment shown the speed of the driving pinion is reduced by the gear train but it is to be understood that the gear train has equal application to arrangements requiring a step-up in the output speed.

The gear assemblies **3** are all identical and for the sake of clarity only one set of numerals will be applied to the drawings, and utilized in the descriptive material following. Thus each gear assembly **3** includes a pair of gears **7**, **8** having different diameters and arranged in juxtaposition with respect to shaft means **9**, **11** extending outwardly from the outer face of each gear. The shafts **9**, **11** are identical save for the bearing hub **12** arranged contiguous to the outer face of gear **7**. That is, each of the shafts **9**, **11** have identical portions, both of which have progressively decreasing diameters by reason of the

plurality of successively arranged cylindrical sections **13**, **14**, **15**, **16** of progressively decreasing diameter.

The gear assemblies **3** thus include the gear pair **7**, **8** as well as the shafts **9**, **11** and one convenient and practical method of fabricating these assemblies is to mold them as a one piece assembly from some suitable material. It has been found that nylon is quite practical although the invention is not limited to such material, nor for that matter, need the gear assembly be a one piece unit.

The gear assemblies are mounted for rotation between a pair of suitable spaced members in the form of the spaced plates **17**, **18**. These plates may be part of a device embodying the gear train as a component part and may be rigidly mounted with respect to each other by means of the threaded spacer members **19** and cooperating nuts **21**. The driving and driven gears **5**, **6** are also suitably journalled for rotation in the plates **17**, **18**.

Cooperating with shafts **9**, **11**, there is arranged a series of oppositely disposed apertures in each of the plates **17**, **18**, the row in plate **17** being of sucessively increasing diameter, starting with the smallest at **22** and progressing upwardly through **23** and **24**, the largest being shown at **25**. The row in plate **18** has the largest aperture **25'** arranged opposite the smallest aperture **22** in plate **17**, the succeeding apertures decreasing in diameter through **24'** and **23'**, the smallest being shown at **22'**.

The large apertures **25**, **25'** are dimensioned to receive the shaft section **13**, the next largest **24**, **24'** to receive section **14**, the second next largest to receive section **15**, and the smallest **22**, **22'** to receive the smallest shaft section **16**. Thus, with the apertures being reversely arranged, it is immediately apparent that at the left-hand gear train extremity, most of the shaft **11** projects outwardly from the plate **18** whereas at the right-hand extremity, most of the shaft **9** projects outwardly from the plate **17**. The step-by-step arrangement of the parts places the left-hand gear pair closest to plate **18** so that its larger gear can mesh with the driving pinion **5**. In the next position, the gear pair are not as close to plate **18** as the first gear pair so its large gear can mesh with the small gear of the first pair. The other two gear assemblies are, in a like manner placed successively and progressively further away from plate **18** to allow proper intermeshing of the complete train. The shoulders formed at the junctions of the shaft sections provide bearing surfaces against the plates **17**, **18**, the hub **12** being provided for a bearing surface immediately between extreme left-hand gear **7** and plate **18** instead of having the gear itself abut the inner side of the plate.

For assembly of the gear train, it is only necessary to drop the gear assemblies in place on one mounting plate and then drop the other mounting plate in place over the other shaft extremities, after which the plates are secured together. The driving and driven gears will be added to the assembly in any convenient manner. While the embodiment shown illustrates a gear train comprising four identical gear assemblies, it is to be understood that the invention has equal application to other numbers of gear assemblies.

Thus, there is provided a novel gear train that is ideally adapted for mass production techniques by reason of the use of pluralities of identical interchangeable parts. Such design permits minimum tool costs, minimum inventory requirements and maximum ease of assembly and servicing. All of the above contributes to low cost manufacturing not heretofore available for mechanisms of this kind.

Therefore, while a particular embodiment of the subject invention has been shown and described herein, it is in the nature of description rather than limitation, and it will occur to those skilled in the art that various changes, modifications, and combinations may be made

within the province of the appended claims, and without departing either in spirit or scope from this invention in its broader aspects.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A gear train comprising a plurality of rotatably mounted intermeshing gear assemblies, each of said gear assemblies having supporting shafts extending outwardly from both sides thereof, each of said shafts having outwardly progressively decreasing diameters, and mounting means for said gear assemblies, said mounting means including a pair of spaced members between which are located said gear assemblies, said spaced members having a series of oppositely disposed apertures for receiving therein said shafts, said apertures having progressively decreasing diameters and being reversely arranged whereby the largest diameter in one series is opposite the smallest diameter in the other series.

2. A gear train comprising a plurality of rotatably mounted intermeshing gear assmblies, said assemblies including a pair of gears of different diameters, supporting shafts for each of said gear assemblies having portions extending outwardly from opposite sides thereof, all of said portions on one side of said assemblies being of equal length and of outwardly successively decreasing diameter, and mounting means for said shafts including a pair of spaced members between which said gear assemblies are located, said members having a series of oppositely disposed apertures therein for receiving said shafts, the apertures in one of said series having diameters successively decreasing through said range of diameters of said shaft portions whereby at one end of said series a greater length of said shaft projects through its cooperating aperture than at the other end of said series.

3. A gear train comprising a plurality of rotatably mounted intermeshing identical gear assemblies, each of said gear assemblies having shaft portions of equal length extending outwardly from opposite sides thereof, said shaft portions having successive sections of outwardly decreasing diameter, and mounting means for said gear assemblies, said mounting means including a pair of spaced members between which are located said gear assemblies, said spaced members having a series of oppositely disposed apertures for receiving therein predetermined sections of said shafts, said apertures having successively decreasing diameters and being reversely arranged in said members whereby the largest diameter in one series is opposite the smallest diameter in the other series.

4. A gear train comprising a plurality of rotatably mounted intermeshing identical gear assemblies, said assemblies including a pair of juxtaposed gears having different diameters, shaft means extending outwardly from each side of said gear assemblies, said shaft means having identical portions of progressively decreasing diameter, and mounting means for said shafts including a pair of spaced plates between which said gear assemblies are located, each of said plates having a series of oppositely disposed apertures therein to receive therethrough portions of said shafts, said apertures having progressively decreasing diameters and being reversely arranged whereby the largest diameter in one series is opposite the smallest diameter in the other series.

5. A gear train comprising a plurality of rotatably mounted intermeshing identical gear assemblies, said assemblies including a pair of juxtaposed gears having different diameters, each of said assemblies having shaft portions of equal length extending outwardly from opposite sides thereof, said shaft portions having successive sections of outwardly decreasing diameter, and mounting means for said gear assemblies, said mounting means including a pair of spaced plates between which are located said gear assemblies, said plates having a series of oppositely disposed apertures for receiving therein predetermined sections of said shafts, the diameters of opposite apertures being such that at one end of said series one of said shaft portions projects outwardly from one of said plates and at the other end of said series another of said shaft portions projects outwardly from the other of said plates.

6. A gear train comprising a plurality of rotatably mounted intermeshing identical gear assemblies, said assemblies including a pair of juxtaposed gears of different diameter, supporting shafts for each of said gear assemblies, said shafts having successive sections of outwardly decreasing diameter and mounting means for said shafts including a pair of spaced members between which are located said gear assemblies, said members having a series of oppositely disposed apertures therein for receiving therethrough portion of said shaft members, one row of said apertures having successively decreasing diameters and the other row of said apertures having successively increasing diameters, said diameters varying through the range in variation of said shaft diameters whereby individual pairs of gears are located at successively increasing distances from one of said mounting members.

7. A gear train comprising a plurality of rotatably mounted intermeshing identical gear assemblies, said assemblies including a pair of juxtaposed gears of different diameter, supporting shafts for each of said gear assemblies extending outwardly from opposite sides thereof, each of said shafts having an outwardly converging step-like configuration wherein is provided successive sections of decreased diameter, and mounting means for said shafts including a pair of spaced plates between which are located said gear assemblies, said plates having a series of oppositely disposed apertures therein cooperating with said shafts, one row of said apertures having successively decreasing diameters and the other row of said apertures having successively increasing diameters whereby the shaft section of greatest diameter extends through the plate apertures of greatest diameter and successive shaft sections of reduced diameter extend through successive apertures of reduced diameter.

No references cited.