United States Patent

Decker et al.

[15] **3,674,126**

[45] **July 4, 1972**

[54] TYPE HEAD DRIVE

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[22] Filed: **June 27, 1969**

[21] Appl. No.: **837,040**

[30] **Foreign Application Priority Data**

July 6, 1968 Germany ..... P 17 61 790.2

[52] **U.S. Cl.** **197/55**, 197/16, 197/52

[51] **Int. Cl.** **B41j 1/40**

[58] **Field of Search** 197/16, 52, 55, 18

[56] **References Cited**

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[57] **ABSTRACT**

A type head having circular rows of types forming curved columns, is rotated by a transmission about a first axis at the centers of the circular rows of types, and angularly displaced about a second axis for selecting a type of a curved column. The transmission includes a driving gear and a driven gear having curved meshing teeth located at a point of the second axis, so that the gears remain in meshing engagement when the type head with the driven gear is angularly displaced.

11 Claims, 5 Drawing Figures

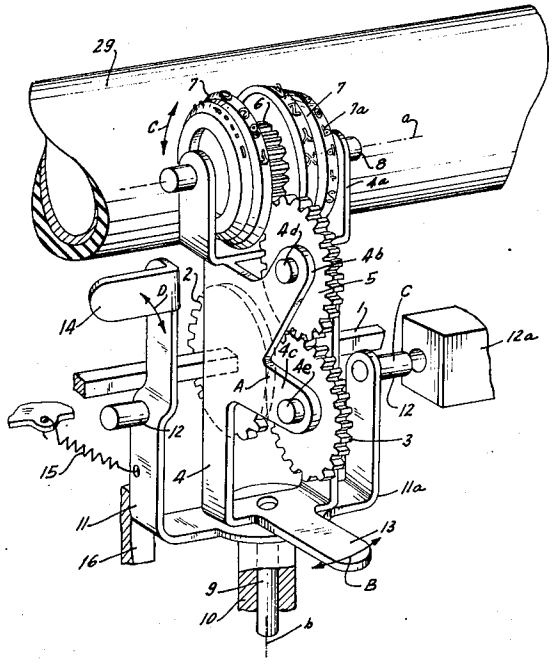


FIG. 1

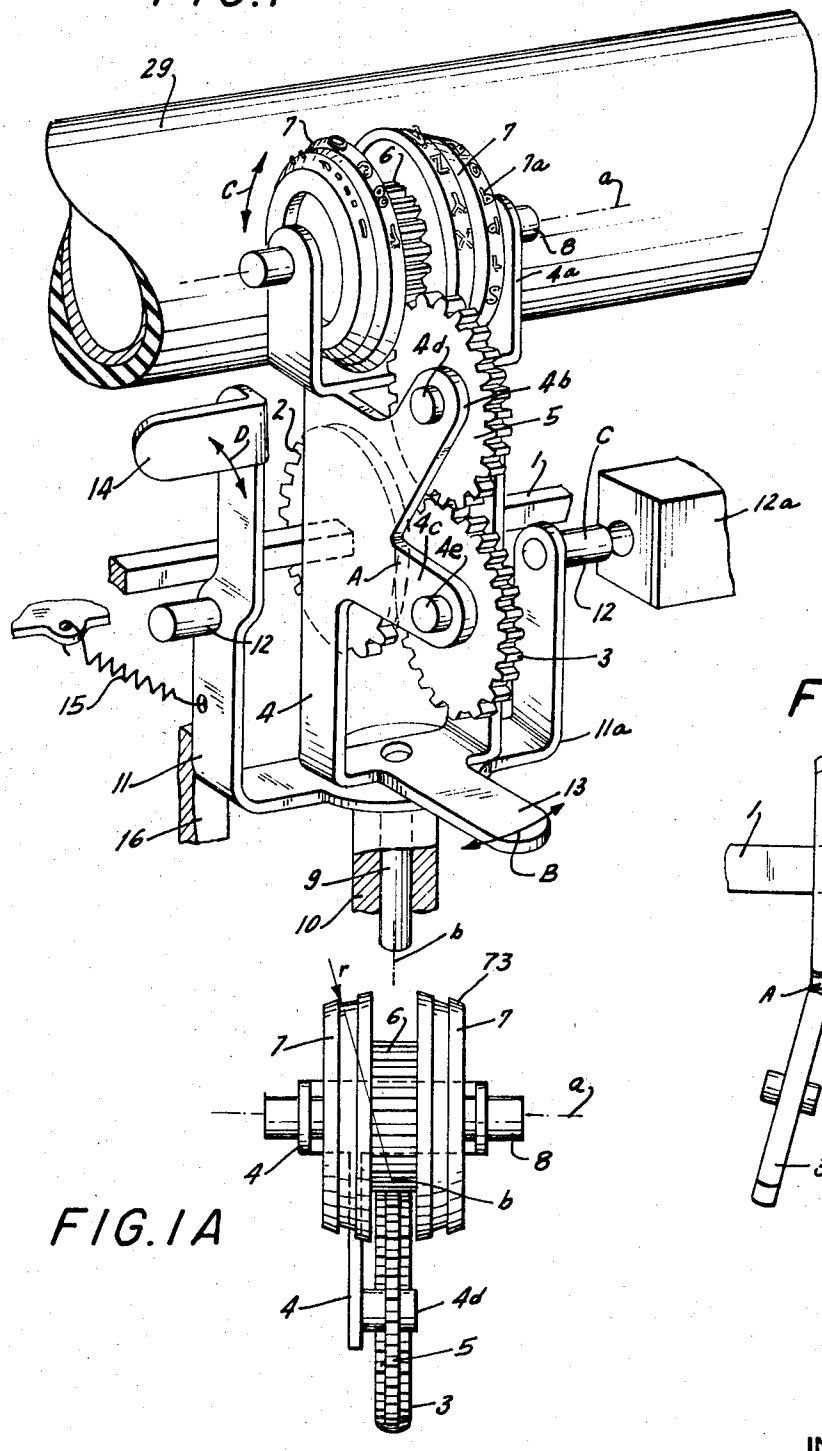


FIG. 1A

FIG. 1B

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FIG. 2

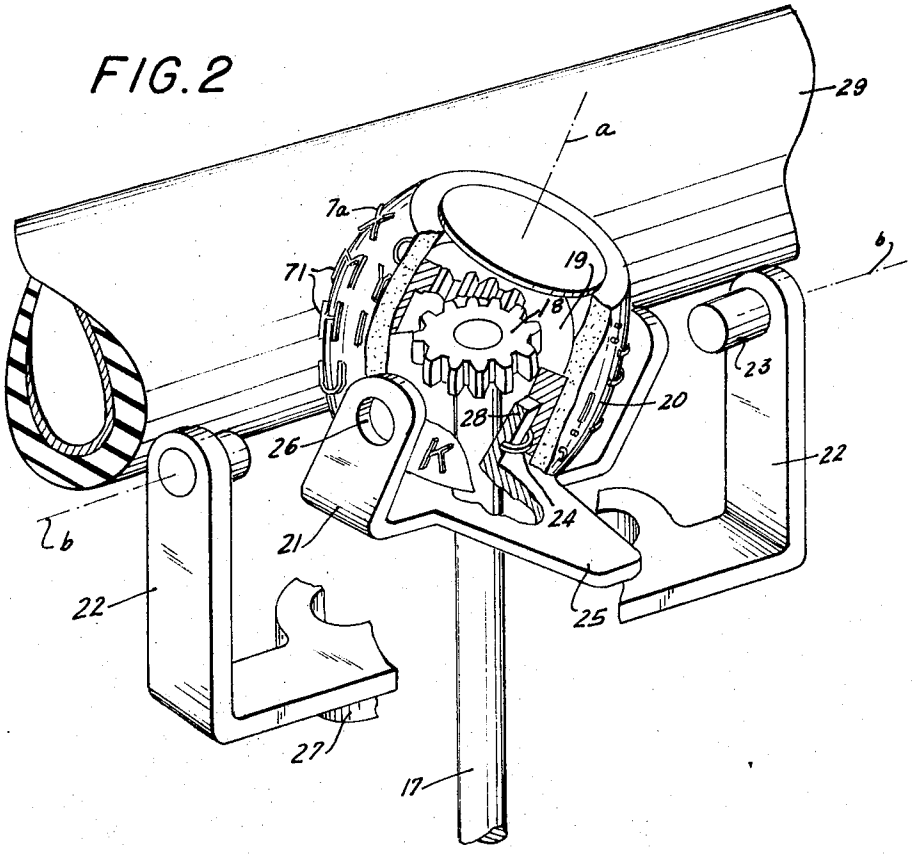
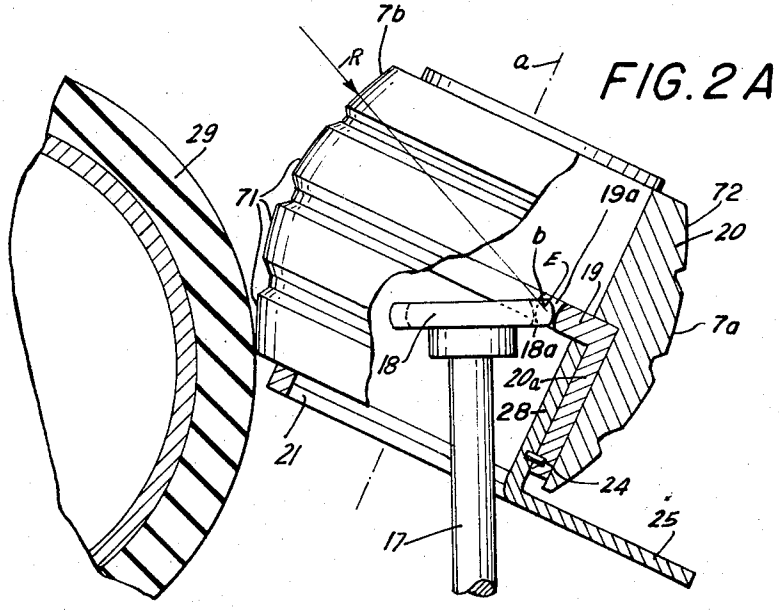


FIG. 2A



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TYPE HEAD DRIVE

BACKGROUND OF THE INVENTION

Type heads having spherical or barrel shape are known which have to be turned about two crossing axes for selecting the type thereon. A movement about a third axis is also necessary for tilting the type head to and from a printing position.

The state of the art is represented by U. S. Pat. No. 2,902,132, U. S. Pat. No. 2,926,768, U. S. Pat. No. 3,247,941, and German Pat. No. 1,198,834.

The type head drives according to the prior art are complicated, and are not always capable of producing clear and accurately spaced imprints. Substantial masses have to be moved, which reduces the typing speed, and some constructions take up a great deal of space of the limited room available in a typewriter.

SUMMARY OF THE INVENTION

It is one object of the invention to provide a type head drive of simple and compact construction, consisting of few parts, and capable of operation at high speed while producing clear and accurately spaced imprints.

Another object of the invention is to provide a type head drive which produces little noise during operation.

With these objects in view, the present invention provides in the transmission by which the type head is rotated, at least two gears having meshing teeth with curved top and bottom lands, permitting a relative angular displacement between the gears while maintaining the meshing engagement.

The meshing gear teeth are arranged in one of the axes about which the type head has to be turned, so that the angular displacement of the type head can be carried out while the type head is rotated about another axis by the meshing gears irrespective of the relative angular position of the same.

An embodiment of the invention comprises a type head having types disposed in circular rows and curved columns; mounting means for mounting the type head for rotary movement about first and second crossing axes; drive means; and transmission means connecting the drive means with a type head for rotating the same about the first axis, and including driving gear and a driven gear having teeth meshing at the point of the second axis.

The circular rows of types have centers located in the first axis so that the curved columns of types are successively placed in an operative position opposite a printing surface during rotation of the type head about the first axis, and any curved column of types located in the operative position has the center of curvature thereof located in the second axis.

The driven gear is connected with a type head for angular movement to a plurality of positions in which different types of a curved column in the operative position are in a position of readiness opposite the printing area of the printing surface. Consequently, any type of an operative curved column can be selected for printing by turning the mounting means with the type head about the second axis.

Such movement does not interfere with the meshing engagement between the driving and driven gears, since the teeth of the driving and driven gears are shaped, and preferably curved, so that the driven gear can be turned with the type head about the second axis, while remaining in unobstructed meshing engagement with the driving gear for rotating the type head about the first axis.

In one embodiment of the invention, a frame supports the type head for rotation about the first axis, and the driven gear is also supported by the frame for rotation about an axis parallel with the first axis. The frame with the type head and driven gear, and other transmission gears can be turned about the second axis which passes through the meshing teeth of the driving and driven gears.

Preferably, the frame is also mounted for turning movement about a third axis passing through the point of the second axis where the teeth of the driving and driven gears mesh so that the frame with the type head can be tilted to and from a printing position without interruption of the meshing engagement between the driving and driven gears.

In another embodiment of the invention, the frame has a journal bushing supporting the type head for rotation about the first axis. A drive shaft carrying the driving gear projects into the type head and meshes in the same with an inner driven gear secured in the type head. The driving and driven gears have curved teeth, as explained above, so that the type head can be angularly displaced about the second axis by operation of the frame, without interruption or obstruction of the driving connection between the driving gear and the driven gear by which the rotation of the type head about the first axis is obtained.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary perspective view illustrating one embodiment of the invention;

FIG. 1A is a fragmentary plan view of a part of the embodiment illustrated in FIG. 1;

FIG. 1B is a fragmentary plan view illustrating meshing gears having curved teeth in an angular meshing position;

FIG. 2 is a fragmentary perspective and partly exploded view illustrating the second embodiment of the invention; and

FIG. 2A is a fragmentary side elevation, partially in section, illustrating the embodiment of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to the embodiment of FIGS. 1, 1A and 1B, a type head 7 is constructed of two parts connected by a pinion 6, and the entire unit 6, 7 is mounted by means of journals 8 in bearings of a U-shaped portion 4*a* of a frame 4. Frame 4 has arms 4*b* and 4*c* supporting pivots 4*d* 4*e* on which gears 5 and 3 are mounted for rotation about axes parallel to the first axis a of the type head 6 defined by journals 8.

Frame 4 has a downward projecting shaft 9 which is turnable in a tubular bearing 10 secured to the yoke 11*a* of a U-shaped support 11 which has a projecting portion 14, and a pair of journals 12 supported in bearings of supporting means 12*a*. Shaft 9 and tubular bearing 10 define a second axis *b* about which frame 4 can turn with gears 3, 5, 6 and type head 7, and journals 12 define a third axis *c* about which frame 4 can be tilted to and from a printing position in which types 7*a* engage a printing surface on the platen 29.

The types 7*a* are arranged in four circular rows having centers in the first axis *a* defined by journals 8, and as type head 7 turns about this first axis, columns consisting of four types 7*a* are successively placed opposite the printing surface during rotation of the type head 7 about the first axis.

When operating means of known construction, not shown, act on the projection 13 of frame 4, the same turns about the second axis defined by shaft 9 in the direction of the arrow B to a position in which a selected type 7*a* of the respective operative column is located opposite a printing area on platen 29, and if a character has been selected in this manner, other operating means of known construction, not shown, act on the projection 14 of support 11 to turn the support 11, and frame 4 with type head 7 to a printing position in which the selected type makes an imprint. A spring 15 restores the normal position of support 11 with frame 4 and type head 7. A shaft 1 having a square cross section, or being serrated or provided with a key groove, supports a gear 2 in such a manner that gear 2 rotates with shaft 1, but is movable along the same when support 11 is moved by known escapement mechanism or tabulating means along the platen 29. Evidently, the arrangement may be reversed in a known manner to make support 11 stationary, and to move a paper carriage with platen 29.

As best seen in FIGS. 1B, the driving gear **2** has curved gear teeth **2***a* meshing with curved gear teeth **3***a* of a driven gear **3** at a point A located on the second axis *b* of the type head defined by shaft **9**, and also on the third axis defined by journals **12**. Gears **5** and **6** are standard spur gears and the teeth of gear **5** mesh smoothly with the curved teeth **3***a* of the driven gear **3** which is always located in the same plane as gear **5**. The axis *b* passes through the center of the flank of the meshing gear tooth **2***a*, as best seen in FIG. **1**B.

When the first axis *a* of type head **7** is parallel to the platen **29**, the gears **2** and **3** are located in a common plane. In order to select one type of a column of four types **7***a*, the type head **7** must be turned about the second axis *b* defined by shaft **9** in the direction of the arrow B so that the driven gear **3** assumes an angular position in relation to the driving gear **2**. The meshing engagement is nevertheless maintained since the bottom lands **2***c*, **3***c* and top lands **2***b*, **3***b* of the teeth and **3***a* are curved to prevent engagement between the lands of gears **2** and **3** when gear **3** is turned. As is apparent from FIG. **1**A, the angle which the type head **7** has to be turned with gear **3** to place the outermost rows of types **7***a* in an operative position, is about 20° so that the curvature of the lands on gears **2** and **3** can be rather flat.

Tilting of the support **11** about the third axis defined by journals **12** in the direction of the arrow D also displaces frame **4** with driven gear **3** relative to driving gear **2**, but the meshing engagement is maintained.

Due to the fact that the second axis *b* of shaft **9** and the third axis *c* of journals **12** intersect at the point A and that the meshing teeth **2***a* and **3***a* are curved, the meshing engagement between gears **2** and **3** is maintained in all angular displaced positions so that type head **7** can be rotated by the transmission **2**, **3**, **5**, **6** in the direction of the arrow C about the first axis defined by journals **8**.

In order to obtain a imprint of an selected type, frame **4** with shaft **9** is turned in the tubular bearing **10** so that a selected circular row of types **7**, including the selected type, is located opposite the platen **29**. This causes an angular position of the driven gear **3** in relation to the driving gear **2**, as shown in FIG. **1**B, but since the meshing engagement is maintained, drive shaft **1** drives the transmission **2**, **3**, **5**, **6** and thereby the type head **7** to rotate about the first axis *a* so that the selected character of the selected circular row of characters is placed opposite the printing area, whereupon tilting of support **11** causes tilting of the type head to a printing position.

As best seen in FIG. **1**A, the type head is barrel shaped so that each column consisting of four types **7***a* is curved. The center of curvature of the column of types **7***a*, which is located opposite the printing surface, coincides with the second axis *b* defined by shaft **9** and bearing **10**, and passing through point A where the teeth **2***a* and **3***a* mesh. Therefore, each type **7***a* of a column of types is spaced the same distance from the printing surface when the type head is in the respective printing position after having been turned about the second axis *b* defined by shaft **9** and tubular bearing **10**. FIG. **1**A shows the radius *r* of the curved column of types **7***a* which are located opposite the printing surface.

Referring now to the second embodiment illustrated in FIGS. **2** and **2**A, the mounting means of the type head **20** include a frame **21** having a pair of aligned bearings **26** in which pivots **23** secured to a U-shaped support **22** are located. The yoke of support **22** forms a bearing **27** for a drive shaft **17**. Frame **21** has a projecting portion **25**, and a journal bushing **28** defining a first axis *a* about which type head **20** turns. A bushing **20***a* is fixedly secured to an inner circular recess in type head **20**, and has a transverse flange portion **19** provided with an inner circular gear **19***a* whose center is located in the axis *a* of type head **20**. The top and bottom lands of gear **19** are curved.

The upper end of drive shaft **17** carries a fixed driving gear **18** with teeth **18***a* whose top and bottom lands are curved. The driving gear **18** meshes with the driven gear **19** to rotate the type head **20** about the first axis *a* while the cylindrical inner surface of the fixed bushing **20***a* slides on the cylindrical outer surface of the journal bushing **28**. A spring ring **24** is inserted into recesses in bushings **20***a* and **28** and secures type head **20** with bushing **20***a* against detachment in axial direction.

Type head **20** is provided with four circular rows **71** of types **7***a* which form curved columns due to the barrel shape of type head **20**.

In accordance with the invention, the teeth of driving gear **18** and driven gear **19** mesh at a point E or a second axis *b*, which is defined by pivots **23** and bearings **26**.

The curvature of the barrel-shaped type head **20** is selected so that the column **72** of four types **7***a*, which is located opposite the printing surface of platen **29**, has a center of curvature located in the second axis *b*. Consequently, when by operation of projecting portion **25** of frame **21**, frame **21** with type head **20** and gear **19** is turned about the pivots **23** defining the axis *b*, the distance between the printing surface of platen **29**, and the operative type **7***a* of any of the four circular rows of type faces **7***a* remains the same. Each column of four characters has a radius R and a center located in the axis *b*.

FIG. **2***a* shows a position of the type head in which a first circular row **71** of types is operative so that the respective types **7***a* successively pass the printing surface when drive shaft **17** is driven, and type head **20** rotates about the axis *a*. FIG. **2**A shows the type in engagement with the platen **29** during a printing operation, but the selection of a type and rotation of the type head is carried out while the same is spaced from the platen **29** and the printing surface. When the column in which the selected type is located passes the printing surface, angular displacement of frame **21**, **25** about the second axis *b*, places the selected type **7***a* opposite the printing surface. During the angular adjustment of the type head **20** about the axis *b*, gears **19**, **18** remain in meshing engagement due to the fact that the axis *b* passes through the meshing point E, and the relative angular displacement between the meshing teeth of gears **18** and **19** is not obstructed since the top and bottom lands of the gears are suitably curved.

Support **22** is mounted on supporting means, not shown, for movement about a third axis parallel to the platen **29**, so that frame **21** with type head **20** can be tilted to and from the printing position shown in FIG. **2**A. The legs of support **22** may be extended, not shown, and provided with pivots mounted in bearings of supporting means by which the third axis is defined, similar to the construction shown in FIG. **1**.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of type head drives differing from the types described above.

While the invention has been illustrated and described as embodied in a type head drive in which the meshing teeth of a pair of gears are located in an axis about which the type head is angularly displaced, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. Type head drive comprising, in combination, a type head having types disposed in circular rows and curved columns; mounting means for mounting said type head for rotary movement about a first axis and for angular movement about a second axis crossing said first axis at right angles, said circular rows of types having centers located on said first axis so that said curved columns of types are successively placed in an operative position opposite a printing surface during rotation of said type head about said first axis, any curved column of types located in said operative position having the center of curvature thereof located on said second axis; drive means; and transmission means connecting said drive means with said type head for rotating the same about said first axis, and including a driving gear and a driven gear having teeth meshing on said second axis, said second axis passing through a point of said meshing teeth in a direction tangential to said drive gear and driven gear, said driven gear being rotatably mounted on

said mounting means with said type head, said mounting means being mounted for angular movement about said second axis between a plurality of positions in which different types of a curved column in said operative position are in a position of readiness located opposite a printing area of said printing surface whereby any type of an operative curved column can be selected for printing by turning said mounting means with said type head and driven gear about said second axis, the teeth of said meshing driving and driven gears having top and bottom lands, at least one of said lands of the teeth of one of said gears being curved so that said driven gear can be turned with said type head about said second axis relative to said drive gear to an angular position in which said top and bottom lands of said drive gear and driven gear remain spaced from each other whereby said drive gear and said angularly displaced driven gear mesh without obstruction when the outermost columns are in said operative position.

2. Type head drive as claimed in claim 1, wherein said drive gear and said driven gear are spur gears.

3. Type head drive as claimed in claim 1 wherein at least the top lands of said teeth of said meshing driving and driven gears are curved.

4. Type head drive as claimed in claim 1 wherein said driving and driven gears are spur gears having teeth with curved top lands and curved bottom lands.

5. Type head drive as claimed in claim 1 comprising supporting means mounting said mounting means with said type head and said driven gear for tilting movement about a third axis from said position of readiness to a printing position in which a type abuts said printing area, said third axis intersecting said second axis at said point so that tilting movement of said mounting means about said third axis causes displacement of said driven gear relative to said driving gear while said gears remain in meshing engagement.

6. Type head drive as claimed in claim 1 wherein said mounting means include a frame supporting said type head for rotation about said first axis, and supporting said driven gear for rotation about an axis parallel with said first axis, and a support supporting said frame for angular movement with said type head and said driven gear about said second axis.

7. Type head drive as claimed in claim 6 comprising means supporting said support for turning movement with said frame about a third axis intersecting said second axis at said point whereby said support, frame and type head can be tilted about said third axis to and from a printing position while said driving and driven gears remain in meshing engagement.

8. Type head drive as claimed in claim 7 wherein said transmission means include gear means connecting said driven spur gear with said type head and being mounted on said frame; wherein said frame has a shaft extending in the direction of said second axis; and wherein said support includes a U-shaped member having a tubular bearing for said shaft, and pivot means defining said third axis and being mounted on said supporting means.

9. Type head drive as claimed in claim 1 wherein said mounting means includes a journal bushing mounting said type head for rotation about said first axis; wherein said drive means include a drive shaft projecting through said journal bushing into the interior of said type head; wherein said driving gear is secured to said drive shaft within said type head; and wherein said driven gear is an inner gear secured in said type head for rotation therewith about said first axis.

10. Type head drive as claimed in claim 9 wherein said mounting means include a frame having said journal bushing, and a support supporting said drive shaft for rotation and supporting said frame for angular movement about said second axis so that when said frame is turned with said type head about said second axis to positions in which different types of a curved column of types are in said position of readiness, said driving and driven gears are angularly displaced relative to each other while remaining in meshing engagement.

11. Type head drive as claimed in claim 10 wherein said frame has a pair of bearings located on opposite sides of said type head and said journal bushing along said second axis; and wherein said support is U-shaped and has a yoke with a bearing for said drive shaft, and legs having pivots located in said bearings, respectively, for supporting said frame for angular movement about said second axis together with said type head and said inner driven gear, and relative to said driving gear.

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