March 24, 1959 F. W. KERFOOT 2,878,684

BAND CLUTCH

Filed April 18, 1957

Fig. 1

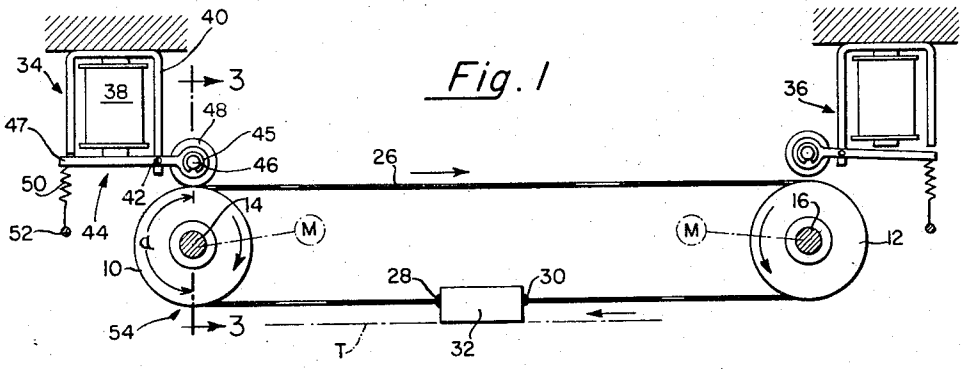


Fig. 2

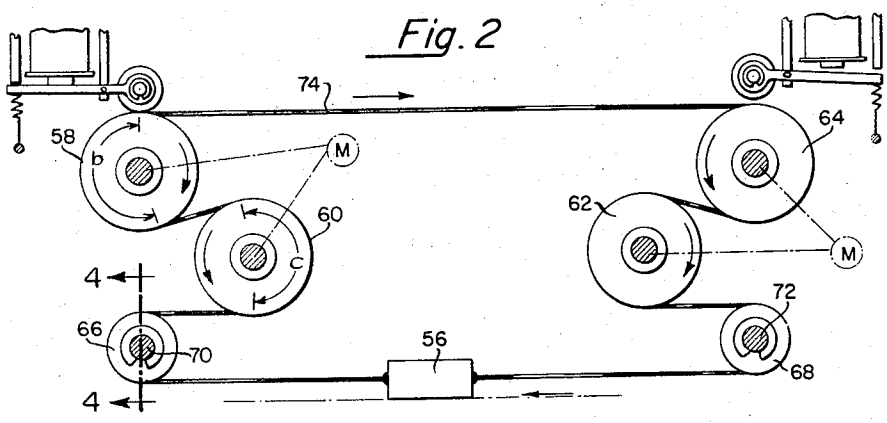


Fig. 3

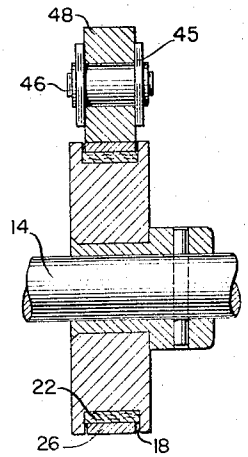
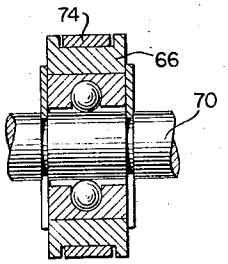


Fig. 4



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BAND CLUTCH

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3 Claims. (Cl. 74—222)

This invention relates generally to improvements in drive means and more particularly to high speed clutches.

An important object of the invention is to provide a novel, fast-acting clutching apparatus.

Another object is to provide a clutching apparatus for achieving high speed movement of a machine element.

A further object of the invention is to provide a high speed clutching apparatus which may be actuated by a minimum of power.

A still further object is to provide a fast-acting clutching apparatus for actuating bi-directional high speed movements of an element in a machine or other apparatus.

A more specific object is to provide a clutching apparatus for effecting bi-directional high speed transverse carriage movements in business machines such as typewriting and printing machines.

For the purpose of illustration, the invention will be described with reference to its use in actuating bi-directional movements of a business machine carriage, but it is to be understood that it is capable of much wider application. When used in such machines, the invention may be applied with equal facility to known types of transversely movable business machine carriages, such as those which support a record medium and those which support a character printing apparatus. The former carries a record medium and moves it transversely back and forth during printing across a relatively stationary character printing apparatus, while the latter or character printing apparatus carriage is transversely movable relative to a stationary record medium carriage and may be referred to as a type-bearing carriage or print head carriage.

Briefly described, and in accordance with one form of the invention shown in the drawings for actuating bi-directional movements of a machine element, or as illustrated diagrammatically, a business machine carriage, the invention comprises a pair of constantly rotating capstans which are rotated in opposite directions. One capstan provides for rightward movements of the carriage while the other capstan provides for leftward movements of the carriage. A flexible belt or band is trained about the capstans and is secured to the carriage for drawing it leftward and rightward. When the carriage is held stationary in an inoperative position, both of the capstans have sliding motion within the band, the band being provided with a sufficient amount of slack for that purpose.

Each of the capstans is associated with a magnetic actuating means of low mass which is selectively energized for urging the band into frictional engagement with the respective capstan. The frictional force at the point of engagement between the band and the capstan is progressively and rapidly amplified due to the "wrap around" of the band about the capstan, resulting in a high-speed response of the band in clutching the capstan and moving the carriage.

The invention will best be understood from the following detailed description of specific embodiments thereof when read in conjunction with the following drawings in which:

Fig. 1 is a front elevation, partly diagrammatic, of one form of apparatus constructed in accordance with the present invention;

Fig. 2 shows a modified form of the apparatus shown in Fig. 1;

Fig. 3 is a section through 3—3 of Fig. 1; and

Fig. 4 is a section through 4—4 of Fig. 2.

In one form of the invention illustrated in Fig. 1, there are provided two capstans **10** and **12** which are secured to two drive shafts **14** and **16** respectively, and adapted to be rotated therewith in opposite directions from a suitable source of power such as electric motors M.

The capstans are similarly constructed and are provided with circular grooves **18**, Fig. 3, and are lined at the base of the grooves with circular bands **22** of a friction material secured thereto. The grooves **18** provide a track for a flexible band **26** which has its ends **28** and **30** fastened respectively to the left and right sides of a carriage **32** which is supported for transverse movement, or for movement in translation on a trackway as illustrated diagrammatically by broken line T, the carriage being shown in block diagram form. Sufficient slack is provided in band **26** so that when carriage **32** is held stationary in an inoperative position the capstans will have sliding motion within the band.

It will be understood at this point that if band **26** clutches capstan **10** carriage **32** will be moved leftward and that if the band clutches capstan **12** carriage **32** will be moved rightward. In order to effect such clutching actions at selected times, each capstan is associated with a magnetic actuating apparatus indicated generally at **34** and **36** respectively. Since both of the actuators are similar in construction and operation, a description of only one of them will be given.

The actuator associated with capstan **10** comprises an electromagnet **38** which is selectively energized from a suitable source of current at desired times for effecting a clutching action of band **26** about capstan **10**. Magnet **38** is mounted in a fixed inverted U-shaped frame **40** which carries at its lower end a pivot pin **42** for pivotally mounting an armature **44**. The armature is bifurcated at one end **45** and carries a shaft **46** on which is rotatably mounted a roller **48**. One end of a helical spring **50** which serves to bias armature **44** to a normal or non-operative position, see actuator **36**, is secured to the opposite end **47** of the armature while its other end is secured to a fixed pin **52**.

Whenever it is desired to effect a leftward movement of carriage **32** magnet **38** is energized. The magnet attracts armature **44** and causes it to rock clockwise against the biasing action of spring **50** whereby roller **48** is brought against band **26**, as shown in Fig. 1, and caused to exert a pressure against the band and capstan. This pressure results in a friction force in the band at the point of contact, and due to the "wrap around" of the band about the capstan from the point of contact to the lower point of tangency **54** represented by angle *a*, the friction force will be amplified sufficiently to move the carriage at high speed in the appropriate direction. Thus it will be seen that a low current may be applied to magnet **38** for moving the low mass armature **44** and roller **48**, whereby the initial frictional force is amplified rapidly to provide a high frictional driving force.

During such times when the carriage is being moved leftward the band will be taut from the point of contact of roller **48** with capstan **10** to the left side of carriage **32** in a direction passing counterclockwise around the capstan and rightwardly to the point of attachment of

the end 28 of the band to the carriage. The initial slack in the band will then be distributed in the remainder of the band from the point of contact of roller 48 rightwardly and around capstan 12 to the right side of the carriage where the end 30 of the band is attached, so that no appreciable frictional "drag" or interference of the counter-rotating capstan 12 will be encountered during the leftward movement of the carriage.

The electromagnetic actuating apparatus indicated generally at 36 and the capstan 12 are constructed and operate similarly to those just described; therefore it will be obvious that they will be similarly effective in producing rightward movements of the carriage.

Fig. 2 shows a modified form of the invention in which there is provided for leftward movements of a carriage 56, also shown here in block diagram form, a pair of power driven counter-rotating capstans 58 and 60, and for rightward movements of the carriage 56 a pair of power-driven counter-rotating capstans 62 and 64. Besides the additional capstans, there are also provided two idler pulleys 66 and 68 which are mounted for rotation on fixed shafts 70 and 72 respectively. In all other respects the modified form of the invention is similar to that previously described, except that the idler pulleys 66 and 68 are preferably not provided with a friction material lining about their circular pulley grooves.

The modified form of the invention provides a higher accelerating force on carriage 56 and therefore a higher speed of operation than the form of invention previously described. This is accomplished by the additional driving capstans 60 and 62 and by their positions relative to capstans 58 and 64 respectively. Thus it will be seen that the angle of wrap-around *b* of band 74 about capstan 58 is more than angle *a* of Fig. 1, thus increasing the clutching force. The clutching force is further increased by the additional wrap-around of the band about capstan 60 represented by the angle *c*, so that the frictional forces in the band at capstans 58 and 60 act together to effect a higher carriage acceleration leftward. It is understood, of course, that the relative positions of adjacent capstans 58 and 60, and 62 and 64 may vary, but preferably they are such that the combined degree of wraparound is greater than 180°. It will be obvious that rightward movements of carriage 56 will similarly be accomplished by capstans 62 and 64 and their associated electromagnetic actuating apparatus.

It will thus be seen that the invention provides a novel friction clutching apparatus adapted for effecting high-speed movements of a mass such as a machine element or business machine carriage by the application of a low actuating force; and while the invention is not to be limited to business machines, it finds special application therein, particularly as an improvement over known types of carriage actuating mechanisms.

It is to be understood that the specific forms of the invention as herein shown and described are to be taken as preferred embodiments thereof, and that various changes in size, shape, and arrangement of parts may be resorted to without departing from the spirit of the invention, or the scope of the subjoined claims.

What is claimed is:

1. A friction clutching apparatus for imparting motion to a machine element comprising, a flexible band having its ends attached to said element from opposite directions for drawing the same selectively in either of said directions, a pair of spaced rotatable capstans each having a peripheral friction driving surface, said band being looped around said capstans with a substantial area of said friction driving surfaces in sliding engagement with said band, means for rotating said capstans simultaneously in opposite directions, and means associated with each of said capstans and selectively operable to press said band into initial frictional engagement with a portion of said area of the selected capstan whereby the rotation of said capstan and the inertia of said element will cause additional and progressive frictional engagement of said band around said capstan until the whole of said substantial area thereof is frictionally engaged by said band to thereby move said element in the selected direction with a frictional force greatly exceeding that effected initially by said pressing means.

2. A friction clutching apparatus for imparting motion to a machine element comprising, a flexible flat band having its ends secured to said element from opposite directions for moving said element selectively in opposite directions, a pair of axially displaced counter-rotatable capstans each having a peripheral friction driving surface, said band being looped around said capstans with a substantial area of said friction driving surfaces in sliding engagement with said band, means for maintaining said engagement for more than 180° around each of said capstans, means for rotating said capstans simultaneously in said counter-rotating directions, and electromagnetic actuating apparatus associated with each of said capstans, said last means each including a roller normally removed but operable to press said band into initial frictional engagement with a portion of said area of its associated capstan whereby rotation of said capstan and the inertia of said element will cause additional and progressive frictional engagement of said band around said capstan until the whole of said substantial area of more than 180° is frictionally engaged by said band to thereby move said element in one of said directions with a frictional force greatly exceeding that effected initially by said electromagnetic actuating apparatus.

3. A friction clutching apparatus according to claim 1 characterized further in that said pressing means is electromagnetic.

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