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Bock

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[54] **HYDRAULICALLY ACTUATED CUTTING MACHINE FOR RODS AND THE LIKE**

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[51] **Int. Cl.**.....**B26b 17/00**

[58] **Field of Search**.....30/180, 182, 208, 30/241, 272

[56] **References Cited**

UNITED STATES PATENTS

3,626,445	12/1971	Penix	30/180
2,776,481	1/1957	Northcutt	30/180
2,714,250	8/1955	Twedt	30/180

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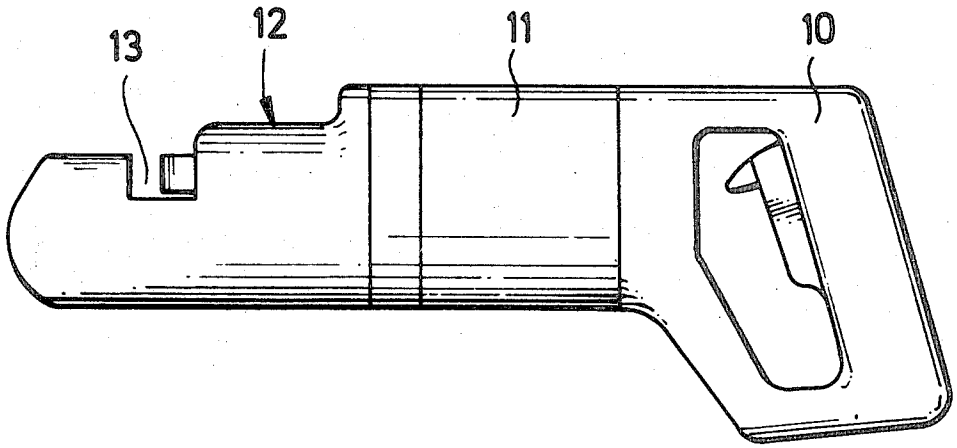
[57] **ABSTRACT**

A hydraulically actuated cutting machine for cutting round steel rods and the like having a stationary cutting member which coacts with a movable cutting member. A pump body has a shaft to which there is operatively connected a pumping member which pumps hydraulic fluid from the pump body into an adjoining cylindrical member. A piston, having a piston rod eccentrically extending therefrom, is slidably mounted in this cylindrical member. The piston rod terminates at the aforementioned movable cutting member. A cutting mouth housing is formed with an open recess, one wall of which faces the movable cutting member and forms the stationary cutting member. The housing adjoins the cylindrical member and defines a chamber which is in communication with the interior of the cylindrical member. The cylindrical member in turn is in communication with the pump body via a passage which is selectively sealed by valve means which coact with the piston.

4 Claims, 3 Drawing Figures



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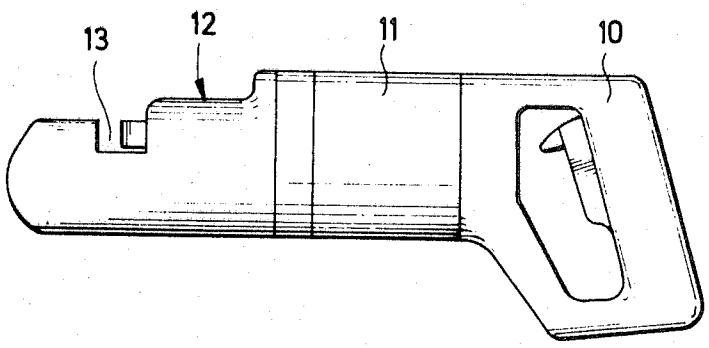

Fig. 1

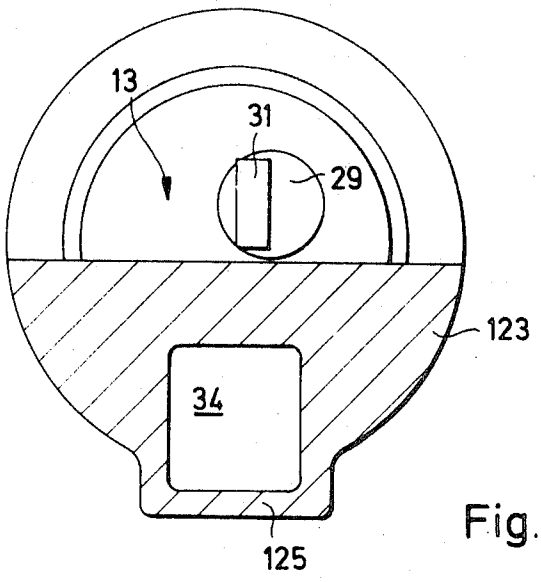

Fig. 3

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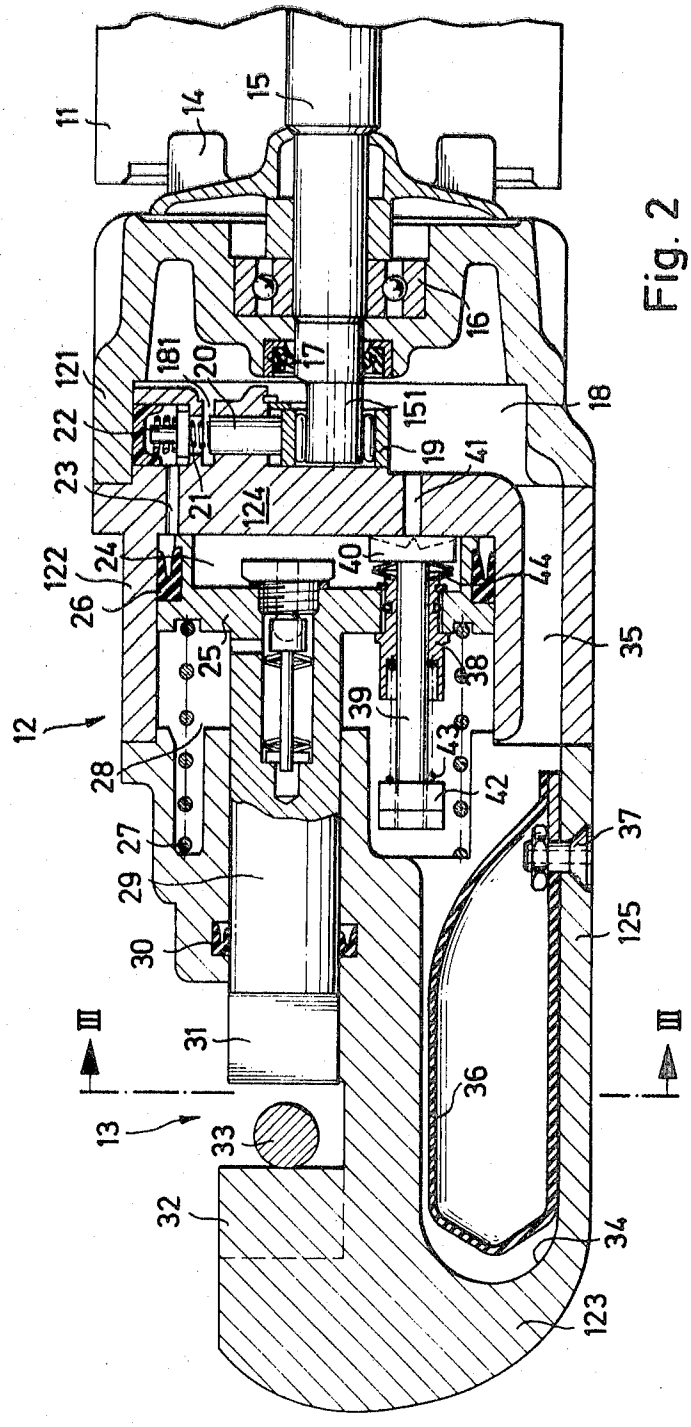

Fig. 2

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HYDRAULICALLY ACTUATED CUTTING MACHINE FOR RODS AND THE LIKE

BACKGROUND OF THE INVENTION

The invention relates to a hydraulically actuated cutting machine, particularly adapted for cutting round steel rods with a movable cutting knife which coacts with a stationary knife member. The device comprises a drive motor which coacts with a pump. The pump is adapted to pump hydraulic fluid from a first housing into a second housing in which there is movably mounted a piston member having a piston rod which terminates in the aforementioned movable knife. Cutting machines of the aforedescribed type are already known in the art.

SUMMARY OF THE INVENTION

It is a general object of this invention to provide an improved construction of the aforedescribed known cutting machine. In particular, it is an object of this invention to provide an improved configuration of a cutting machine which is easier to handle and more compact in construction.

It is a further object of this invention to construct the cutting machine in such a way that the person servicing the same can at all times observe the actual cutting operation performed by the knife extending from the piston rod.

It has been found advantageous that cutting machines of the aforedescribed type should have a cylindrical configuration with a relatively small diameter and should be otherwise constructed as compactly as possible, so that access can be had at each cutting location in particular when cutting steel mats. Furthermore, the cutting knife itself should be arranged in such a way that it is visible to the person servicing the machine.

The aforedescribed objects of this invention are obtained by arranging the piston shaft, which is formed as a cutting knife, at its free end, eccentrically relative to the piston and thus also eccentrically with respect to the cylindrical chamber in which the piston is mounted. The cylindrical chamber adjoins at one side thereof a housing having a recess, which is laterally open and accessible, and has a wall surface which constitutes the stationary knife, and at the other side thereof, a housing forming a pumping chamber accommodating a pump for pumping hydraulic fluid into the cylindrical chamber. With this arrangement a very compact configuration of the cutting machine is obtained, wherein the cutting mouth is laterally open with respect to the substantially cylindrical configuration of the cutting machine, so that the cutting operation can be observed at all times by the person servicing the machine.

Due to the fact that the piston shaft is eccentrically mounted on the piston proper, the requirement of securing the piston against undesirable rotation is eliminated. Such securing of the piston is normally necessary when the piston shaft is concentrically arranged with respect to the piston surface, because of the lateral forces that are produced when a movable cutting knife is cutting an object. Thus the special guide means for securing the piston against turning, are not required in the arrangement of this invention. The large space that becomes available in the range of the stroke of the piston due to the eccentric arrangement of the piston rod can be utilized for a valve arrangement which controls the stroke and return stroke of the piston.

Due to the configuration of the cutting mouth in the cutting machine of this invention, wherein the cutting mouth is laterally displaced towards the periphery of the cutting machine, there is obtained a space in the forward portion of the cutting machine which is utilized for providing the space required for accommodating the displaced hydraulic fluid, thus avoiding the necessity of increasing the diameter of the cutting machine. This displacement chamber is required in order to compensate for the volume of the piston rod which exits during the working stroke of the piston from the closed hydraulic system. In the arrangement of the cutting machine of this invention there is provided a hollow body with a flexible wall which defines an enclosed space within the cutting machine. This enclosed space is in communication with the ambient atmosphere via a venting passage so that this flexible wall is compressed and released in synchronism with the working and return stroke of the cutting machine.

BRIEF DESCRIPTION OF THE DRAWING

The nature of the invention and its advantages will appear more fully from the following detailed description taken in conjunction with the appended drawing, in which:

FIG. 1 is a pictorial representation of the entire cutting machine of the invention;

FIG. 2 is a partial longitudinal cross-sectional view of the front end of the cutting machine showing the most important features of the invention; and

FIG. 3 is a sectional view along III—III in FIG. 2.

DETAILED DESCRIPTION

Referring now to the drawings, it can be noted from FIG. 1 that the cutting machine of this invention is meant to be handled manually. The cutting machine has at its rear end a manual gripping member **10**. A central housing portion **11** adjoins the gripping member **10**. An electromotor, which is not illustrated in detail in the drawings, is mounted in the central housing **11**, and serves to drive the hydraulic pumping means of the machine. The hydraulic pumping means of the machine are mounted in head portion **12** of the machine which also includes the cutting mouth **13**.

As is illustrated in detail in FIG. **2**, the head portion **12** consists of three separate sections which are: a pump body **121**, a cylindrical body **122** and a cutting mouth body **123**. These three sections are joined to each other as per welding or bolting so that they are firmly secured to each other in a fluidtight manner. The three sections are joined to each other in a substantially coaxially aligned relationship. A shaft **15** extends from the non-illustrated electric motor into the inner race of a roller bearing **16** which is mounted in a recess of the pump body **121**. A fan wheel **14** is coaxially mounted on the shaft **15**. A ring seal **17** is mounted in another recess of the pump body **121** and seals off oil storage chamber **18** so that no oil may leak out therefrom along the shaft **15**. An eccentric end portion **151** extends from the shaft **15** and is connected via a raceway **19** to a radial piston rod **20** which is reciprocally mounted in a passage extending radially through the wall **124** separating the oil storage space **18** of the pump body **121** from the space in the cylindrical body **122**. The radial piston rod **20** is actuated against the force exerted by a return spring **21** which bears, on the one hand, against the piston rod **20**, and on the other hand,

against a spring loaded valve body 22 of a one way valve. The valve body 22 controls a hydraulic fluid inlet passage 23 which leads into the cylindrical space 24 of the cylindrical body 122 of the cutting machine.

A piston head 25 provided with a seal ring 26 is slidably mounted within the cylindrical body 122 and is actuated against the force exerted by a return spring 27. The return spring 27 abuts with it its left end, as shown in FIG. 2, against a wall surface located in the cutting mouth body 123 and at its right end against the wall of a recess in the piston head 25. As can be noted from FIG. 2, the piston head 25 is at least nearly concentrically arranged with respect to the shaft 15 of the electric motor and thus substantially concentrically arranged with respect to the longitudinal axis of the cutting machine. The piston head 25 has a unitary piston rod 29 which extends eccentrically therefrom. The piston rod 29 is slidably mounted in a mating passage provided by a flange portion of the cutting mouth body 123; the flange portion of the cutting mouth 123 is provided with a recess in which there is mounted a sealing ring 30 which serves to seal off the hollowed space defined by the cylindrical body 122 and the cutting mouth body 123. The piston rod 29, which extends through the flange portion of the cutting mouth body 123, is formed at its free end as a cutting knife 31 which extends into the cutting mouth 13 of the cutting machine.

Due to the fact that the piston rod 29 is arranged eccentrically with respect to the piston head 25 and, consequently, also eccentrically with respect to the longitudinal axis of the cutting machine, the cutting knife 31 and the stationary knife 32 coacting therewith are also offset with respect to the longitudinal axis of the cutting machine, so that the two coacting knives 31 and 32 can be observed as they are performing a cutting operation, for example, on a round steel rod 33 located in the cutting mouth 13. The fact that this observation is made so much easier, simplifies and speeds up the entire cutting operation.

The eccentric arrangement of the piston rod 29 in the cutting mouth body 123 also makes it possible to accommodate in the cutting mouth body 123, which is preferably made of cast iron, a large free space which serves as a displacement chamber 34. As can be noted in particular from the cross-sectional view illustrated in FIG. 3, this displacement chamber 34 does not substantially weaken the structural integrity of the cutting mouth body 123. Thus, it can be noted that the displacement chamber 34 extends into the outer portion of the cutting mouth body 123 which is located opposite the cutting mouth 13, forming in said cutting mouth body 123 a slight projection. This projection continues in the cylindrical body 122 of the cutting machine and forms in this cylindrical body a passage 35 which communicates the oil storage chamber 18 in the pump body 121 of the machine with the displacement chamber 34, the latter being in communication with the cylindrical chamber 28 which has a bottom wall formed by the backside of the piston head 25.

A hollow rubber body 36 is disposed within the displacement chamber 34. This hollow rubber body is formed by flexible walls which define an inner space disposed in the wall defining the projection 125. A valve member 37 is secured to the rubber body 36 by a thread and nut connection, as is shown in FIG. 2. This valve member 37 communicates the hollow space in the rubber body 36 with the outer atmosphere, so that the rubber body 36 can be easily compressed.

Due to the fact that the piston rod 29 is eccentrically arranged on the piston head 25, there is produced sufficient space to accommodate the cylindrical support body 38 in the piston head 25. A rod 39 is slidably mounted in the cylindrical support body 38 and has mounted on its right end, as viewed in FIG. 2, a valve closing member 40 which is adapted to close the passage 41 extending through the wall 124 of the cylindrical body 122. The passage 41 acts as an oil return flow passage. The valve closing member 40 is dish-shaped so that only its outer peripheral surface abuts and seals off the oil return flow passage 41, the wall surface of the wall 124 acting as a valve seat. There is mounted on the other side of the dish-shaped valve closing member 40 a dish-shaped spring 44 which bears against the valve closing member 40. As the piston head 25 is moved towards the left, as viewed in FIG. 2, by the hydraulic fluid pressure which is pumped into the passage 23, the pressure exerted on the piston head 25 and the piston rod 29, as the piston head 25 undergoes its working stroke, would also be exerted on all other surfaces in the cylindrical chamber 24 and thus on the dish-shaped spring 44 and the valve closing member 40. The free end of the rod 39 is provided with a stop member 42, which forms a stop surface for a coil spring 43, the other end of which abuts in the recess of the support body 38. The various members 38, 39, 41, 42, 43 and 44 are so dimensioned that, after a preselected maximum stroke of the working piston 25, 29, the valve closing member 40 is lifted off the oil flow return passage 41. The exact construction of the aforementioned valve arrangement 38, 39, 40, 41, 42, 43 and 44 is, for example, described in detail in the German published Pat. application No.1 652 753 (Offenlegungsschrift).

The cutting machine of this invention operates as follows: After the electro-motor has been switched on, it drives the eccentric end 151 of the shaft 15. The rotating end 151 of the shaft 15 then reciprocates the piston 20 by means of the raceway 19 thus imparting a reciprocal movement on the piston rod 20. The piston rod 20 thus causes hydraulic fluid to flow through the inlet passage 181 from the oil storage chamber 18 to the opened valve in which the valve body 22 is mounted, and thus through the inlet passage 23 into the cylindrical chamber 24. The main piston head 25 is shown in its inactive position in FIG. 2 In this position, the oil backflow passage 41 is closed by the valve body 40 and remains closed even though pressure is increasing in the cylindrical chamber 24, said increasing pressure causing the piston head 25 to move to the left, as viewed in FIG. 2. As the piston head 25 moves to the left, the piston rod 29 and the cutting knife 31 move in the same direction towards the stationary cutting knife 32 situated in the cutting mouth 13 of the machine and, if a round steel rod 33 is located in the cutting mouth 13, this rod will be cut. After the piston head 25 has reached a non-illustrated left forward position, the force exerted by the coil spring 43 exceeds the force exerted on the pressure surface of the valve closing member 40 by the pressure present in the cylindrical chamber 24 or the support body 38 abuts against the stop member 42 of the shaft 39, so that the valve closing member 40 is lifted off its valve seat and the oil return flow passage 41 is opened so that the oil under pressure may exit from the cylindrical chamber 24 and

flow back into the oil storage chamber **18**. As the piston head **25** undergoes its stroke the oil present behind it in the cylindrical chamber **28** is required for the cylindrical chamber **24** in front of the piston head **25**. The differential volume produced by the piston rod **29** exiting from the chamber **28** is compensated by the hollow rubber body **26**.

As the piston head **25** is moved back towards right into the inactive position illustrated in FIG. **2**, the valve body **40** remains closed due to the action of the coil spring **43** against the piston head surface until, after the inactive position has been reached by the piston head **25**, the latter acts on the valve closing member via the dish-shaped spring **44** and urges it against the wall surface **124**.

FIGS. **2** and **3** illustrate one embodiment of the cutting machine of this invention to scale. It can be noted, how compact the construction is and how easily the machine can be handled. The cutting knife **31** which is offset with respect to the longitudinal axis of the machine, moves parallel to this longitudinal axis during the cutting operation towards the stationary cutting knife **32** mounted in the cutting mouth body **123** of the machine. The cutting edge of the cutting knife **31** can be arranged in such a way, as viewed in FIG. **3**, that it is centrally located with respect to a central plane in which the longitudinal axis of the machine is also located. During the cutting process there act on the cutting knives unavoidable lateral forces. Due to the offset arrangement of the piston rod **29** with respect to the piston head **25**, these lateral forces do not, however, cause a turning of the piston. Since it is essential that the cutting knife moves parallel with respect to the longitudinal axis of the cutting machine, the fact that no turning of the piston occurs constitutes an important advantage. In contradistinction thereto, in the known concentric arrangements of the piston shaft, there must be provided special guide bodies to avoid that the lateral forces cause a turning of the piston, these guide bodies absorbing the lateral forces.

The arrangement of the cutting machine of this invention is very compact and, due to the closed hydraulic system contained therein, the unavoidable displacement chamber **34** can be accommodated in the space which is gained by means of the eccentric arrangement of the cutting members in the cutting machine, thus avoiding any additional enlargement of the length and causing only a relatively minor increase of the diameter of the cutting machine.

Although the invention is illustrated and described with reference to one preferred embodiment thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a preferred embodiment, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. In a hydraulically actuated cutting machine for cutting round steel rods and the like with a movable knife coacting with a stationary knife, the improvement comprising

a pump housing adapted to hold hydraulic fluid,

pumping means operatively mounted in said pump housing,

a substantially cylindrical housing fluid-tightly and coaxially connected to said pump housing at one of its ends,

passage means communicating said pump housing and said cylindrical housing,

a piston head slidably mounted in said cylindrical housing,

cutting knife guide means fluid-tightly connected to said cylindrical housing at the other one of its end,

and a piston rod eccentrically extending from said piston head and from the other end of said cylindrical housing and through at least a portion of said cutting knife guiding means, (comma) said piston rod being formed as a movable cutting knife at its free end.

2. In a hydraulically actuated cutting machine for cutting round steel rods and the like with a movable knife member coacting with a stationary knife member, the improvement as set forth in claim **1**, wherein said cutting knife guide means comprises a body having a first portion defining a passage through which said eccentric piston rod extends, said first portion also having a laterally open cutting mouth having a wall surface which acts as a stationary cutting knife, said movable cutting knife being adapted to reciprocate relative to said stationary cutting knife, said laterally open cutting mouth being eccentrically disposed relative to the longitudinal axis of said cutting machine, said body of said cutting knife guide means has a second hollow portion defining a displacement chamber for the hydraulic fluid.

3. In a hydraulically actuated cutting machine for cutting round steel rods and the like with a movable knife member, the improvement as set forth in claim **1**, wherein there are mounted on said piston head valve means which control the movement of said piston head in said cylindrical housing, said valve means extending into said cylindrical housing along one side of said eccentrically disposed piston rod which forms an enlarged space in said cylindrical housing due to its eccentric position.

4. In a hydraulically actuated cutting machine for cutting round steel rods and the like with a movable knife member, the improvement as set forth in claim **2**, wherein there is mounted in said displacement chamber a flexible container, and venting means mounted in said second hollow portion and said flexible container for communicating the latter with the ambient atmosphere.

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