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## (54) Digging machine.

(57) A machine for digging trenches includes a boom 12 which can be mounted on a tractor vehicle. The boom carries an endless chain 14 mounting picks. In order to absorb the reaction generated when the picks are in operation a ground engaging plate 18 is provided which can be clamped to the boom.

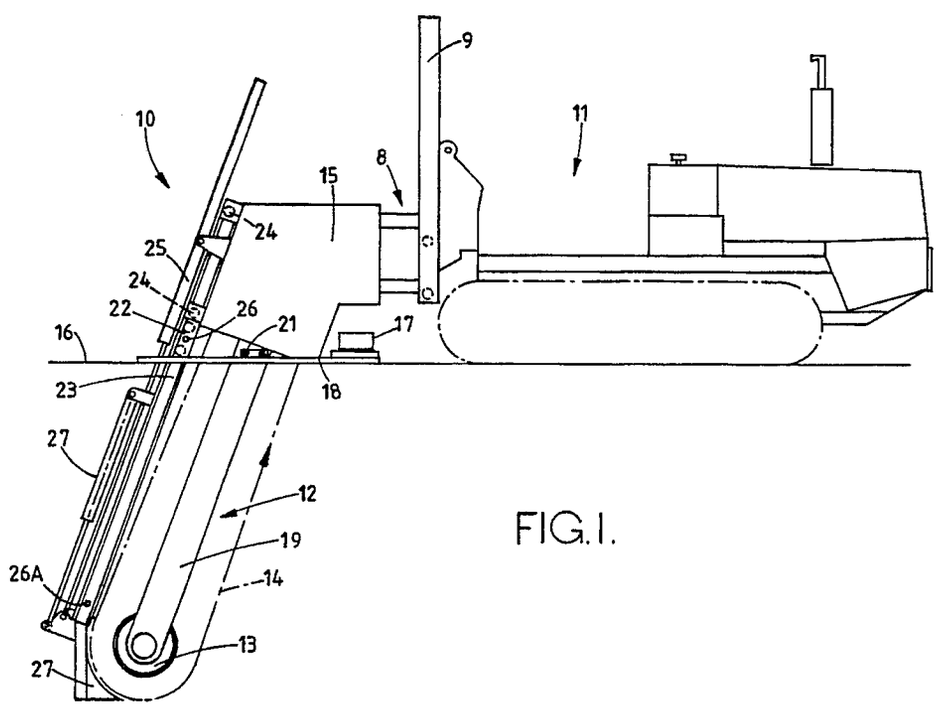


FIG.1.

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This invention relates to a machine for digging trenches and of the kind comprising a boom or mounting upon which is mounted an endless chain, a bucket elevator or saw and support means for the boom or mounting and which in use can be secured to a tractor vehicle.

Such machines are well known in the art and in use, the lower end of the boom or mounting with the chain or elevator rotating, is lowered into the ground to the desired depth of the trench and the tractor vehicle is moved along the desired path of the trench. Picks or the like secured to the chain move upwardly over the advancing end face of the trench and remove material therefrom, the loose material being lifted to above ground level and either deposited to one or both sides of the trench or removed on a conveyor.

The reaction forces which are applied to the boom or mounting tend to cause the boom or mounting to be pulled downwardly. Such downward movement has to be resisted otherwise the trench will be deeper then intended. The most common way of resisting the reaction force is to transmit the force to the tractor vehicle. This requires that the aforesaid support means should be carefully designed and constructed. Even if the support means is able to withstand the reaction forces the forces can influence the operation and performance of the vehicle.

It has been proposed to provide a pair of ground engaging plates on the support means. These can be positioned so that most of the reaction force is transmitted back to the surface of the ground but the reaction force has to be transmitted between whatever connects the boom or mounting to the support means. Moreover, it is often necessary to provide for adjustment of the ground engaging plates relative to the support means.

The object of the present invention is to provide a machine of the kind specified in a simple and convenient form.

According to the invention a machine of the kind specified comprises a ground engaging plate which is movable relative to said boom or mounting and further means operable to secure said ground engaging plate to said boom or mounting whereby the reaction forces developed on said boom or mounting during operation of the machine are transmitted directly to the ground engaging plate and from said plate to the ground adjacent the trench which is being dug.

An example of a machine in accordance with the invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a side elevation of the machine shown mounted on a tractor vehicle, and

Figure 2 is an end view through part of the machine.

With reference to the drawings the machine is shown generally at 10 and is shown mounted (by support linkage 8) on a tiltable mast 9 of a tractor vehicle 11 conveniently of the track laying type. The machine includes an elongated boom 12 which at its opposite ends mounts a pair of shaped rollers 13 only the lower one of which is shown, about which extends an endless chain indicated by the chain dot line 14. The upper roller is located in a housing 15 which carries a hydraulic motor coupled to the upper roller. In use the motor drives the chain in the direction indicated by the arrow.

The boom 12 is shown in Figure 1 to be below ground level 16 and as the chain is driven material is removed by picks mounted on the chain, from the advancing end face of the trench. The material which is removed is lifted by the action of the chain and is deposited for convenience, on a conveyor belt 17 which conveys the material laterally away from the trench.

During the operation of the chain a reaction force is applied to the boom 12 which tends to urge the boom downwardly to increase the depth of the trench and the reaction force is applied to the boom support. In order to absorb the reaction force there is located about the boom 12 a ground engaging plate 18. It is convenient to mount the conveyor 17 on the plate. As will be seen from Figure 2 the plate extends laterally on opposite sides of the boom and forwardly towards the tractor vehicle. The undersurface of the plate bears upon the surface of the ground and the leading edge of the plate considered in relation to the movement of the tractor vehicle, may be upwardly inclined.

When the machine is in use the plate 18 is clamped or otherwise secured to the boom so that the reaction force applied to the boom is transmitted directly to the plate and then to the surface of the ground engaged by the plate. The body of the boom is of substantial construction having side members 19 against which in the particular example are urged a pair of clamping elements 20A, 20B respectively. The elements are of "L" section and the element 20A is rigidly secured to the plate on one side of the boom. The element 20B is slidably secured to the plate and in order to achieve clamping a pair of hydraulic rams 21 are energised. The cylinders of the rams are secured to the plate and the pistons engage the element 20B and urge it relative to the plate into engagement with the boom. The reaction force generated draws the element 20A into engagement with the boom and the practical effect is that the plate 18 is clamped to the boom so that the reaction forces applied to the boom by operation of the chain are transmitted to the plate and from the plate to the ground.

In the example the clamping elements 20A,

20B are formed from metal so that metal to metal contact takes place. In order to improve the clamping action the faces of the elements facing the boom may be provided with a facing of friction material.

Other arrangements may be employed for clamping the plate to the boom for example, the clamping element 20B may be replaced by a wedging member which as the reaction force is applied moves into tighter wedging engagement. The wedge can be in the form of a cylindrical member mounted for angular movement on the plate 18 about an offset axis parallel to but spaced from the adjacent side member 19 of the boom. Release of the clamp can be effected by operation of a piston/cylinder combination which imparts angular movement to the cylindrical member. Alternatively locating pins can be used to secure the plate to the boom.

In Figure 1 the boom is shown at its maximum operating depth. It can be partly raised to reduce the depth of the trench or fully raised and then tilted for transport purposes by operation of hydraulic means on the tractor vehicle and by tilting the mast 9. It is convenient to be able to clamp the plate 18 to the boom before starting to dig the trench and in order to cope with varying depths of trench the plate must be movable relative to the boom.

For the above purpose the plate 18 has a housing 22 secured to its upper surface and at the trailing edge of the plate. The housing mounts a pair of bearing assemblies and extends on opposite sides of an "I" section beam 23 which itself is carried on a pair of bearing assemblies 24 which are mounted on the housing 15. The beam 23 can be moved axially by operation of a piston cylinder combination 25. The latter and the beam are shown in the extended position but for the purpose of adjusting the plate, are retracted to enable a detachable pin (not shown) to be extended through an aperture 26 in the housing 22 and through an aperture 26A in the beam. Once the pin has been inserted and the clamping elements released, the plate 18 can be moved relative to the boom to the desired position after which the plate is clamped to the boom and the pin removed. The beam can then be extended to provide support for a scoop 27 which acts to scrape the bottom of the trench free of any loose debris and to profile the trench. The scoop in pivotally mounted on the end of the beam by means of a further piston/cylinder combination 27 and has to be moved to an inoperative position when adjusting the position of the plate 18.

With the arrangement described the reaction forces generated during operation of the machine are largely absorbed by the plate 18 so that the linkage connecting the machine to the tractor vehicle can be of simpler construction. Moreover, since the reaction force is not applied to the tractor operation of the latter is facilitated, since it is no longer subject to shock loading due to the action of the picks engaging hard material such as stones.

Although the tractor vehicle illustrated is of the track laying type it can be of the wheeled type. Moreover the invention is equally applicable to machines which employ a wheel carrying buckets or picks instead of the endless chain. In this case the ground engaging plate is secured to the mounting for the wheel.

## Claims

1. A machine for digging trenches comprising a boom or mounting (12), an endless chain or bucket elevator or saw (14) carried on the mounting, support means (8) whereby the machine can be secured to a tractor vehicle characterised by a ground engaging plate (18) movable relative to the mounting (12) and securing means (20A, 20B) operable to secure the ground engaging plate (18) to the mounting (12) whereby the reaction forces developed on the mounting (12) during operation of the machine are transmitted directly to the ground engaging plate (18) and from said plate to the ground adjacent the trench which is being dug.

2. A machine according to Claim 1 characterised by means (25) operable to enable the relative position of the ground engaging plate (18) and the mounting (12) to be adjusted prior to clamping the plate to the mounting.

3. A machine according to Claim 1 characterised by a conveyor (17) mounted on said ground engaging plate (18) the conveyor acting to convey material removed during digging of the trench, to some remote position.

4. A machine according to Claim 1 characterised by a housing (15) carried by and located at the upper end of the boom (12), an elongated beam (23) mounted for axial movement on the housing (15), a piston/cylinder combination (25) carried on the housing (95) and operable to move the beam (23) relative to the housing (15), a further housing (22) secured to the plate (18), said further housing being located about said beam (22), and means for detachably coupling said beam to said further housing (22) whereby operation of said piston cylinder combination (25) with said securing means (20A, 20B) released will effect relative movement of the ground engaging plate (18) and the mounting (12).

5. A machine according to Claim 4 characterised in that said beam (22) extends behind the mounting considered in terms of the direction of movement of the boom (12) in use, and carries a scoop (27).

6. A machine according to Claim 1 characterised in that said securing means comprises a pair of clamping elements (20A, 20B) located on the opposite sides of the mounting (12), one of said elements being secured to the plate (18) and the other of said elements being movable on the plate and an hydraulic ram (21) operable to urge said other element into engagement with the mounting and thereby draw the one element into engagement with the mounting.

7. A machine according to Claim 1 characterised in that said securing means comprises a clamping element carried by the plate and engageable with one side of the mounting and a wedge member carried by the plate and engageable with the other side of the mounting.

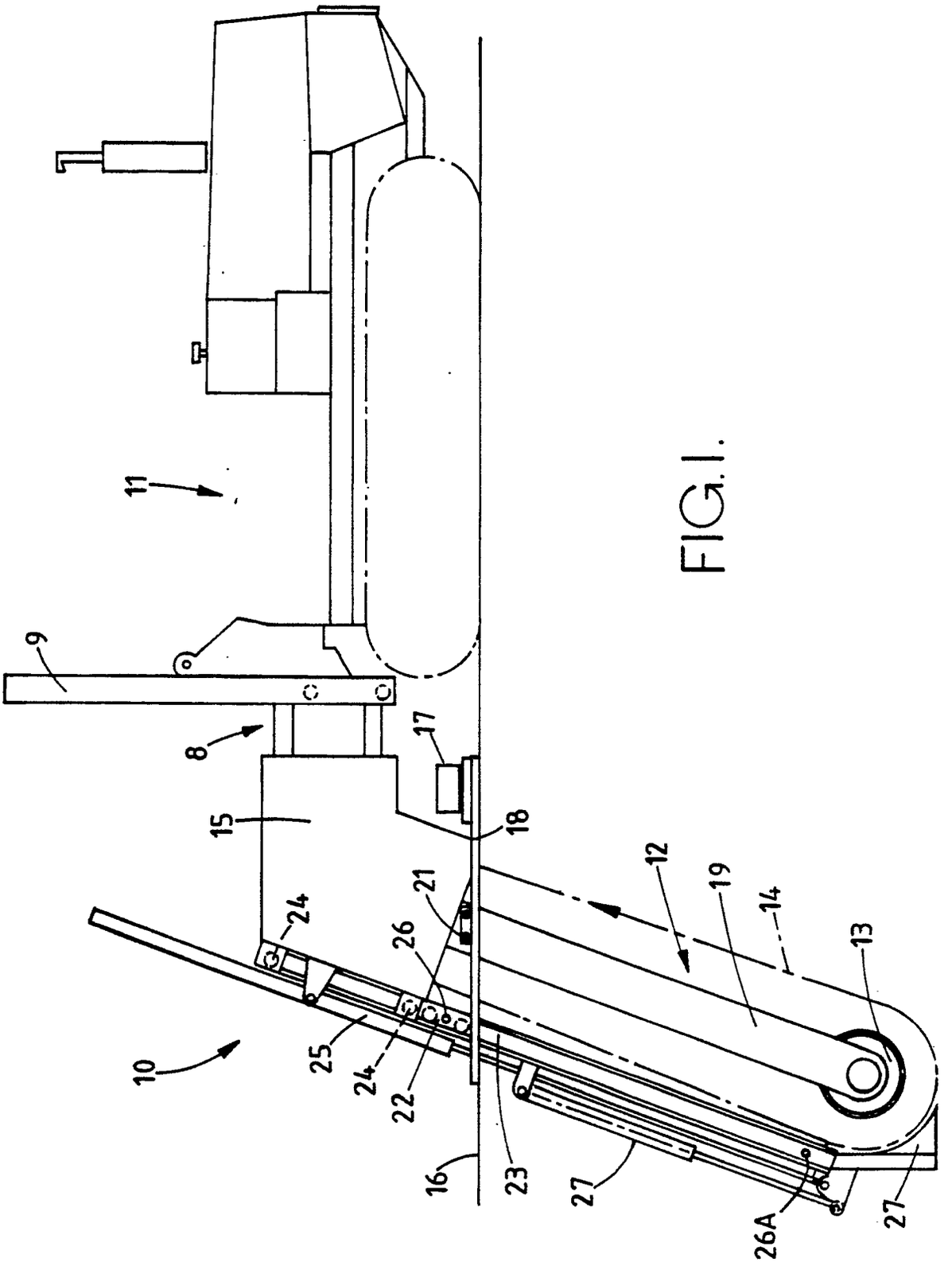


FIG.1.

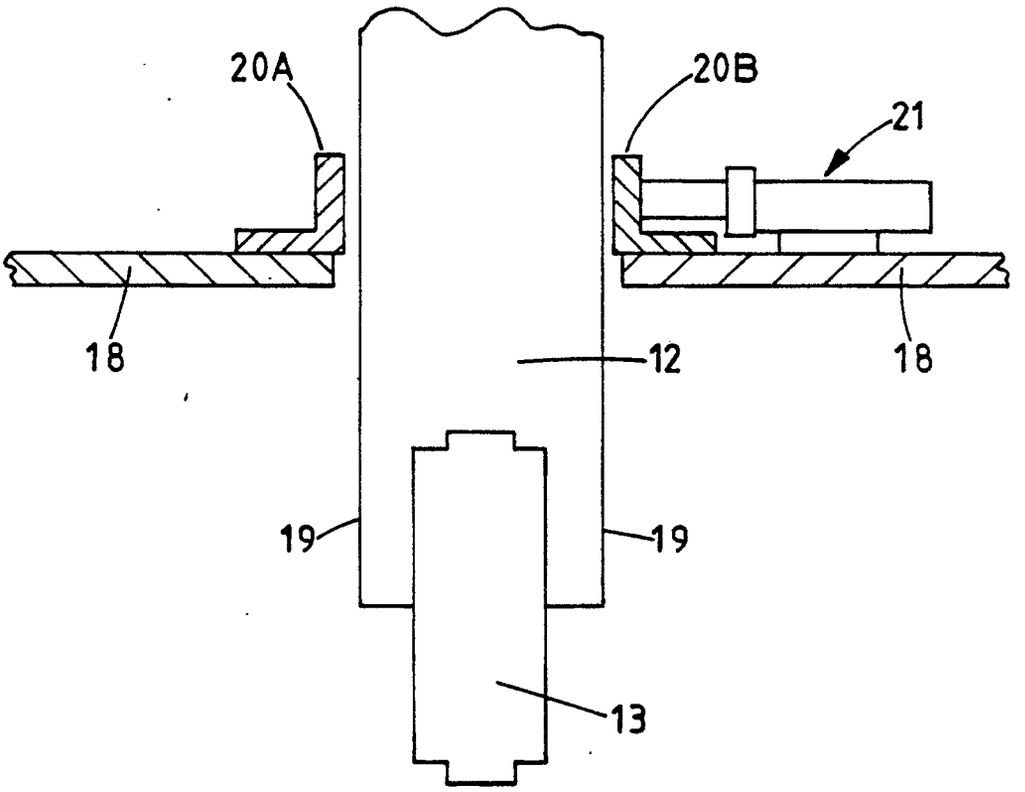


FIG.2.