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(54) Trench digger.

(57) A small capacity trench digger for one-man operation in which a motor drives a toothed, endless, trench-digging chain through a transmission which allows slip if the teeth strike hard material. The chain bar which supports the chain rises and falls in response to lever adjustment which gives a choice of cutting depths as the digger is wheeled over the ground. A tooth pattern is also disclosed which increases the area of contact with the link plates of the chain when the tooth tilts in the act of digging.

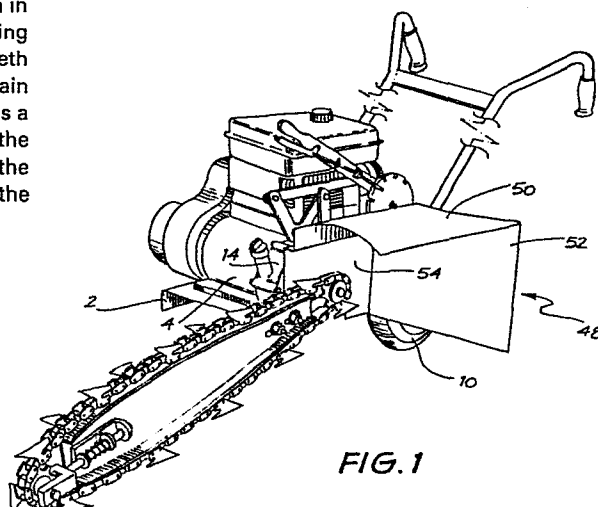


FIG. 1

"Trench Digger"

DESCRIPTION

This invention concerns small capacity trench diggers especially those suited to operation by one man which dig shallow trenches in soil for cables, small pipes,
5 agricultural drains and the like.

BACKGROUND OF THE INVENTION

One known trench digger for small scale use is mounted on a four wheel drive vehicle in which the operator sits in order to steer and operate the 18 H.P. motor which
10 drives an earth digging chain. The chain is driven relatively slowly in comparison to chain fixed cutters and a continuously rotating worm at the rear of the vehicle clears earth from a chamber at the rear of the chain. This digger has a scaled hydraulic motor and pump driven by the
15 18 H.P. motor. Such arrangements enable the two motors to be located out of the path of flying spoil. A small machine cannot economically incorporate a hydraulic system.

U.S. patent 3,614,838 describes a tree digging chain-saw for cutting the earth around trees and discusses the
20 design of earth cutting teeth for such a saw. We have found that such teeth give satisfactory digging in that they clear a path for the chain but they are liable to suffer short life and reduce chain life because they are attached by only two pins to the link plates of the chain and the leverage
25 exerted on the pins by their tooth shape is very high. Besides such saws are dangerous for the operator to hold because obstructions to the teeth are hidden beneath the

ground and sudden shocks are liable to cause an accident.

SUMMARY OF THE INVENTION

This invention provides a trench digger comprising:

a wheeled frame;

5 a handle on the frame enabling the frame to be
guided over the ground by an operator;

a motor and transmission mounted on the frame;

a toothed, endless trench digging chain supported for
rotation by a motor on a chain bar which extends

10 forwardly of the frame, the chain bar being pivoted
for rise and fall in relation to the frame between
a trenching position and a non-working position
clear of the ground in response to a manual adjustment,
the motor and transmission being located in apposition
15 to the chain bar and the transmission incorporates an
overload slip facility.

The chain bar may have an upper end and a lower end;

the transmission may have a housing and a shaft property
horizontally from the housing perpendicular to the bar,

20 and the upper end of the bar pivots about the axis of the

shaft. The shaft may have a sprocket which drives the
endless chain and a collar upon which the chain bar is

mounted for movement in a vertical plane. The overload slip
facility may be a centrifugal clutch which operates at

25 engine speed and drives the shaft through a reduction gear.

A spoil guard may be fixed to the frame and extend between
the upper end of the bar and the transmission housing over

the top of the upper end of the chain bar and to the rear of the chain bar. The frame may have two sides parallel to the direction of trenching and is supported on a pair of wheels with a common axis lying to the rear of the motor, transmission and chain bar with a wheel outboard of opposite sides of the frame, and a centrally placed third wheel giving a triangular wheel disposition.

The earth-digging teeth of the chain may be each of a conformation which increases the area of contact between the tooth and the chain when the tooth is tilted by the act of digging. The tooth may have a body which is pierced in order to receive a pair of parallel chain pins, and a blade which has a leading, inclined cutting edge, a trailing blade edge extending in the direction opposite to the cutting direction which edge overhands a following part of the chain. The chain may contain a plurality of interconnected link plates and the tooth is tiltable in relation to the chain path such that when the trailing edge tilts it contacts the link plate of the chain which lies adjacently rearward of the link associated with the pins upon which the tooth is mounted. The body of the tooth may be bifurcated, being of modified V-shape consisting of a part which receives the pins and is parallel with the link plates and an earth-cutting blade part which has a leading portion which terminates in the leading edge, inclined at a small angle to the chain path axis

in order to give a useful width of trench, the trailing edge being likewise inclined in order to overlies the following link plate.

DESCRIPTION OF THE DRAWINGS

5 Fig. 1 is a perspective view of the machine showing the spoil guard;

 Fig. 2 is a schematic side elevation of the part of the machine with the spoil guard removed;

 Fig. 3 is a side elevation of a portion of the chain
10 showing the disposition of the teeth;

 Fig. 4 is a plan of the subject of Fig. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

 Referring to Figs. 1 and 2, the pressed steel frame 2 supports the crankcase 4 of a motor 6. A handle 8 enables
15 the operator to push the frame on pneumatic wheels 10. Motor 6 is an air cooled 5 H.P. HONDA model SCF with a centrifugal clutch running in an oil bath at engine speed. A 2:1 reduction gear (not shown) produces half engine
 speed at the sprocket 12 equivalent to about 425 meters/min.
20 The clutch and reduction gears are located in the transmission housing 14. Sprocket 12 is mounted on the end of drive shaft 16. Between sprocket 12 and the crankcase 4 is a large diameter bearing 18 around which a collar 20 is clamped. The collar has slotted holes 22 for bolts 24
25 which secure a chain bar 26. The bar thus pivots about shaft 16 under the control of links 28, 30, bellcrank 32, link 34 and lifting and lowering lever 36. A toothed double

quadrant 38 offers depth selection for digging. **0061299**
The bellcrank 32 has a pair of pivots 40, 42 which give additional choice of depth in combination with the quadrant portions. Thus depths of 50, 75, 200, 350, 500, 600 and 520 mm. The quadrants form part of a plate 44 which is bolted to the frame 2. A third wheel 46 positioned near the centre and forwardly of crankcase 4 ensures that the frame 2 maintains a horizontal position on level ground.

Referring particularly to Fig.1, the guard 48 is made of sheet metal and has a curved top 50 and an oblique rear wall 52 directed rearwards in order to direct spoil to the side of the machine and to protect the rear wheel 10 and the operator. A side wall 54 completes the guard which is bolted to place 44.

Referring now to Figs.3 and 4 the chain 56 is a single strand roller chain conventionally constructed of pairs of pins 58, rollers 60 and link plates 62. Each tooth 64 has a body part 66 which lies adjacent to a link plate and is provided with a pair of bores to receive pins 58. The tooth has a blade 68 partially separated from the body by slot 70 to give a bifurcated conformation. The leading edge 72 of the tooth proper is inclined and sharpened. The tooth terminates in a tail 74 and a trailing edge 76 which is set to overlies link plate 78. The trailing edge projects 8 mm. beyond the end of the body part 66.

The chain has twenty-six teeth, thirteen to each side of the chain. Of each set of thirteen, seven are trench-

cutting teeth 78 and the alternate six are chain-
cleaning teeth 80. The chain pitch is 19 mm, the
roller diameter is 12.7 mm.

5 The inclination of the blade 68 in relation to the
tooth body 66 is to scale in these figures.

When the tooth strikes earth during use it tilts ground-
wards tightening the chain. The tilting is arrested as soon
as the tail strikes the following link plate. We have found
longer chain life and longer chain bar life to result from
10 this sharing of pressure among three sites instead of two.

In use the bar is raised horizontal by lever 36, the
motor is pull-started and as the throttle is increased
above 1800 rpm the chain begins to revolve and then reaches
working speed. The lever is released to drop the bar to
15 the selected working depth and spoil is thrown to the left
of the machine by the guard 48. The operator then wheels
the machine rearwards. If the trench needs widening
beyond 100 mm. a wheel axle extension (not shown) is fitted
to the wheel behind the spoil guard and the wheel re-positioned
20 to the left of the existing trench, so that the trench is
straddled by the wheels. A second cut is made parallel
to the first.

We have found the advantages of the digger layout
described in the detailed description to be:

- 25 (a) the machine is very manoeuvrable;
(b) the machine gives access to narrow strips of
ground which cannot be reached by an operator-
ridden vehicle;

- (c) the depth of dig is easily controlled;
- (d) the transmission oil seals keep the transmission oil bath uncontaminated even with the proximity of the digging chain;
- 5 (e) the choice of transmission which initiates and arrests the drive totally by throttle control at 1800 rpm means that if the chain strikes an obstruction and slows the drive shaft the clutch merely slips instead of shearing a valuable
- 10 component.
- (f) trenches may be easily widened by wheeling the machine parallel to an existing cut.

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CLAIMS

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1. A trench digger comprising:
 - a wheeled frame;
 - a handle on the frame enabling the frame to be guided over the ground by an operator,
 - a motor and transmission mounted on the frame;
 - a toothed, endless trench digging chain supported for rotation by a motor on a bar which extends forwardly of the frame, said bar being pivoted for rise and fall in relation to the frame between
 - a trenching position and a non-working position clear of the ground in response to a lever adjustment, the motor and transmission being located in opposition to the chain bar and the transmission incorporates an overload slip facility.
2. A trench digger as claimed in Claim 1 wherein the chain bar has an upper end and a lower end; the transmission has a housing and a shaft projecting horizontally from the housing perpendicular to the bar, and the upper end of the bar pivots about the axis of the shaft.
3. A trench digger as claimed in Claim 2 wherein the shaft has a sprocket which drives the endless chain and a collar upon which the chain bar is mounted for movement in a vertical plane.
4. A trench digger as claimed in any one of claims 1 to 3 wherein the overload slip facility is a centrifugal clutch which operates at engine speed and drives the shaft through a reduction gear.

5. A trench digger as claimed in any one of claims 2, 3 or 4 wherein a spoil guard is fixed to the frame and extends between the upper end of the bar and the transmission housing over the top of the upper end of the chain bar and to the rear of the chain bar.
- 6.. A trench digger as claimed in any one of the preceding claims wherein the frame has two sides parallel to the direction of trenching and is supported on a pair of wheels with a common axis lying to the rear of the motor, transmission and chain bar with a wheel outboard of opposite sides of the frame, and a centrally placed third wheel giving a triangular wheel disposition.
7. A trench digger as claimed in any one of tje preceding claims wherein the earth-digging teeth of the chain are each of a conformation which increases the area of contact between the tooth and the chain when the tooth is tilted by the act of digging.
8. A trench digger as claimed in Claim 7 wherein the tooth has a body part which is pierced in order to receive a pair of parallel chain pins, and a blade which has leading, inclined cutting edge, a trailing blade edge extending in the direction opposite to the cutting direction which edge overhangs a following part of the chain.
9. A trench digger as claimed in claim 8 wherein the chain contains a plurality of interconnected link plates and the tooth is tiltable in relation to the chain

path such that when the trailing edge tilts it contacts the link plate of the chain which has adjacently rearward of the link associated with the pins upon which the tooth is mounted.

10. A trench digger as claimed in Claim 9 wherein the body of the tooth is bifurcated, being of modified V-shape consisting of a part which receives the pins and is parallel with the link plates and an earth cutting blade part which has the leading portion which terminates in the leading edge, inclined slightly away from the link plates and the chain path in order to give a useful width of trench, the trailing edge being likewise inclined in order to overlie the following link plate.

11. A trench digger as claimed in any one of claims 7 to 9 wherein teeth are distributed on both sides of the chain and on each side of the chain some teeth are outwardly directed earth cutting teeth while others are inwardly directed chain-clearing teeth.

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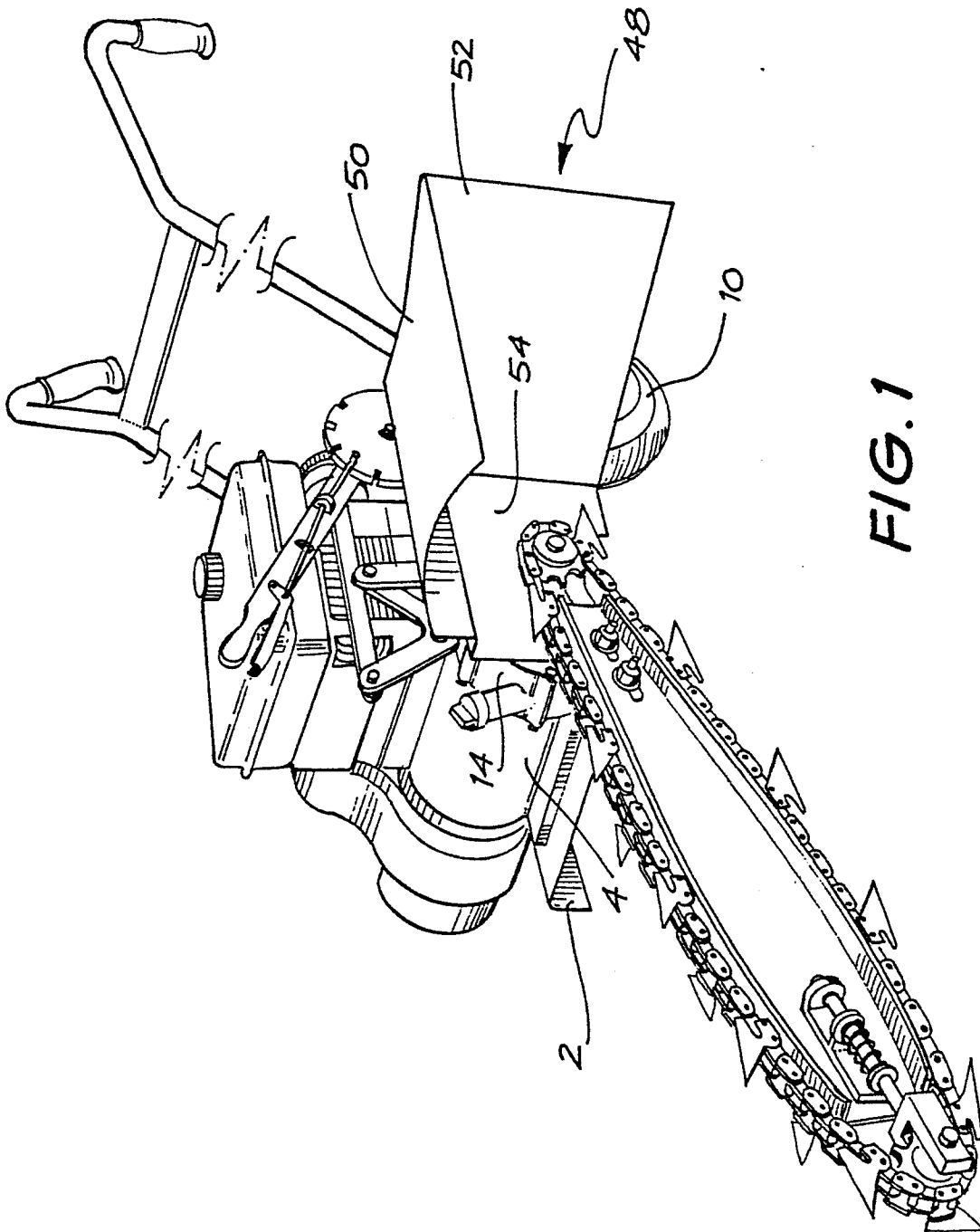
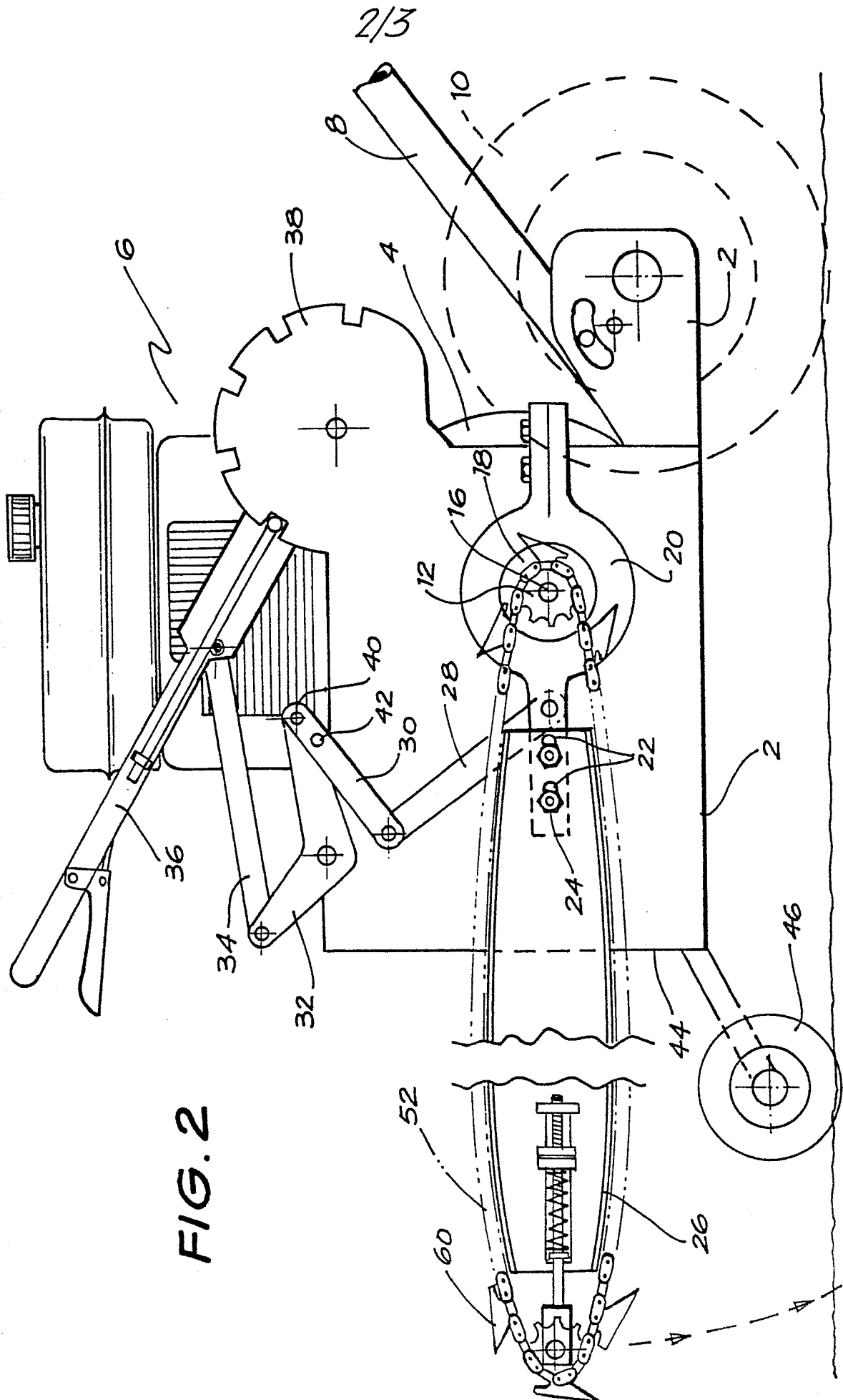


FIG. 1



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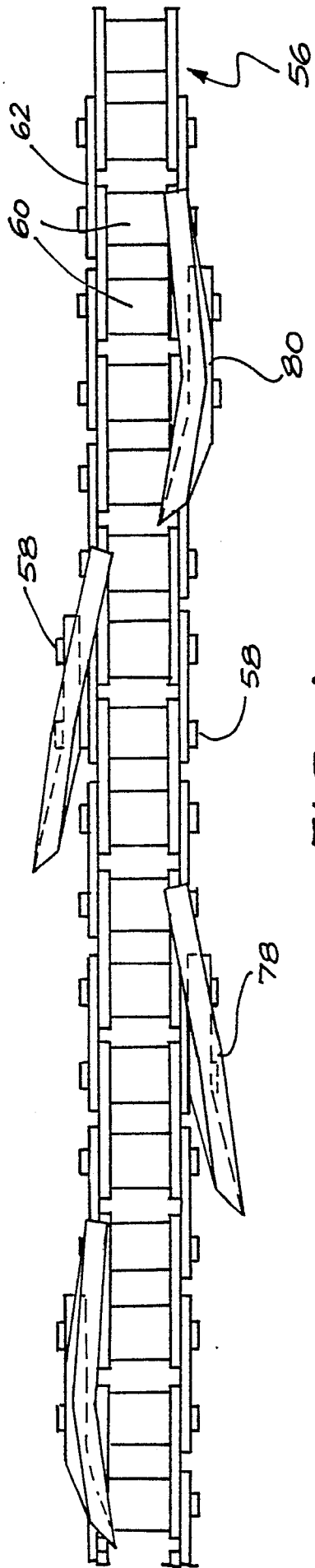


FIG. 4

FIG. 3

