July 2, 1968 D. L. STACY 3,390,755

COAL LOADER

Filed May 19, 1967 4 Sheets-Sheet 1

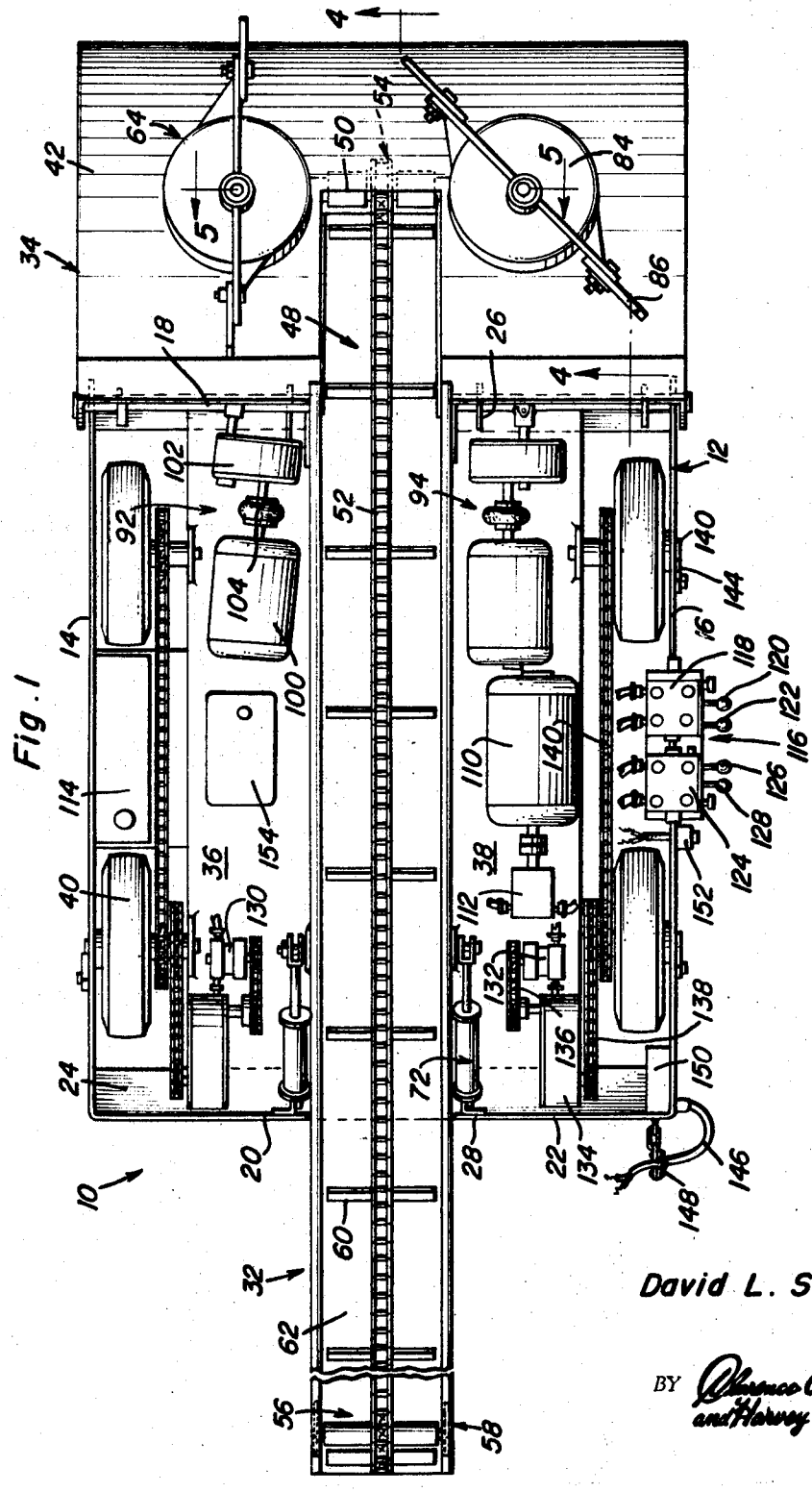

Fig. 1

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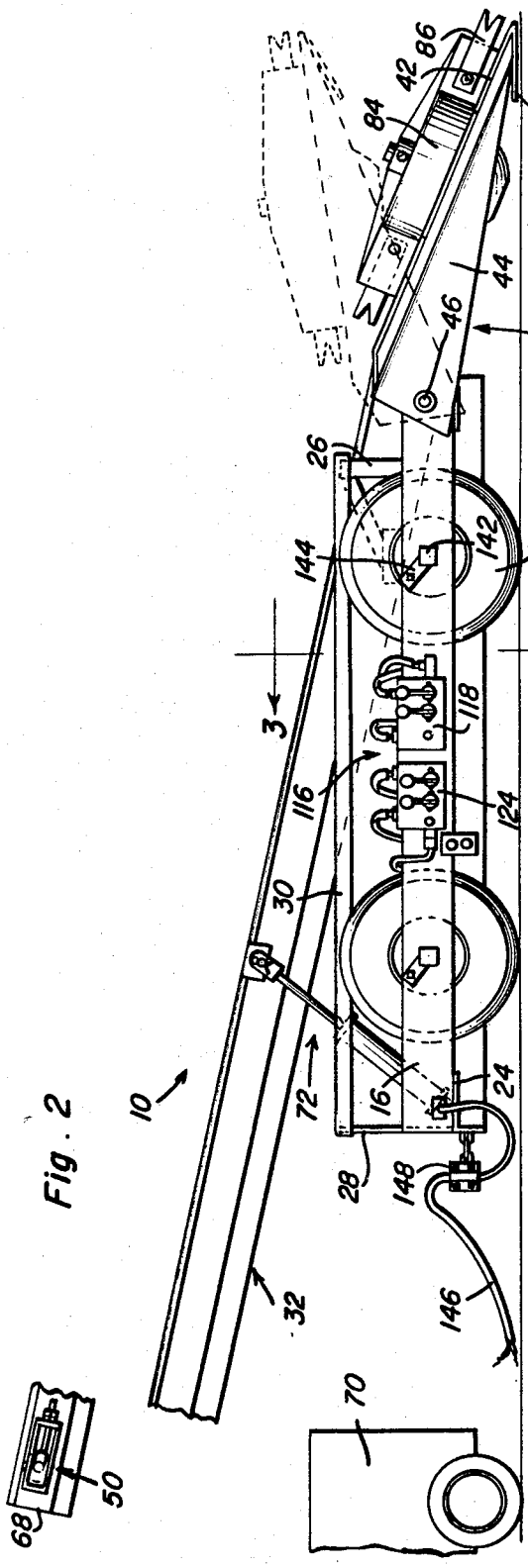

Fig. 2

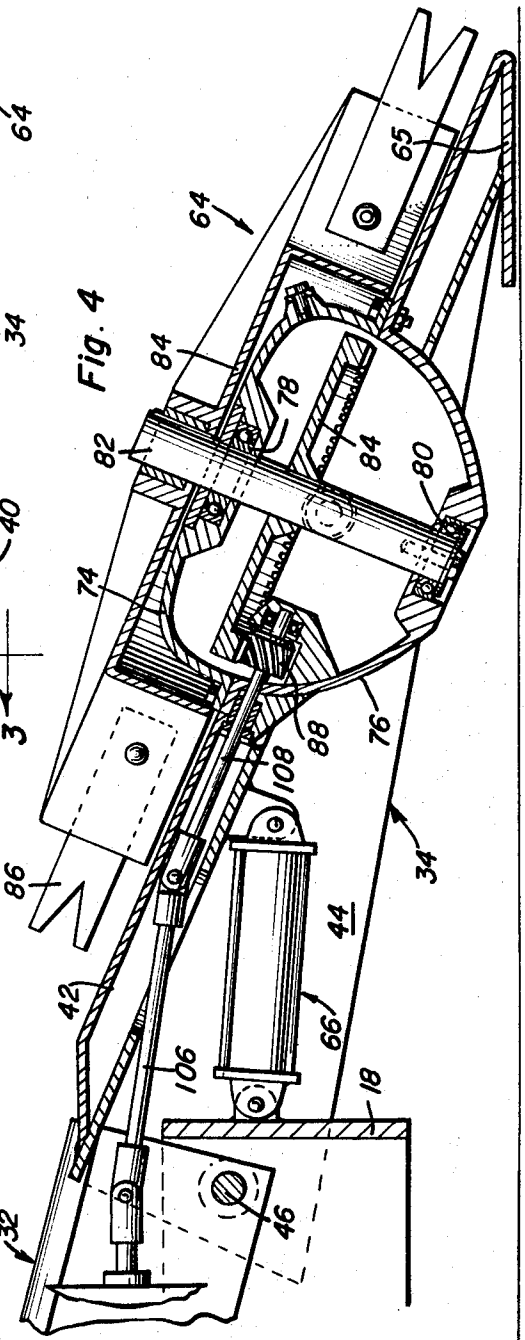

Fig. 4

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COAL LOADER

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Fig. 3

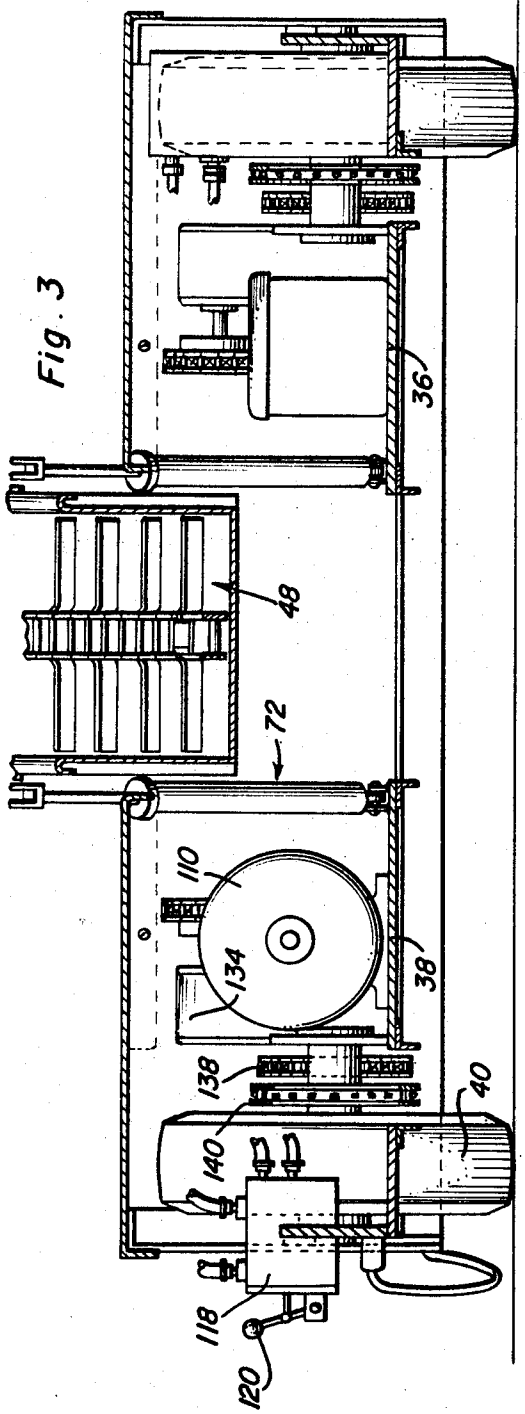
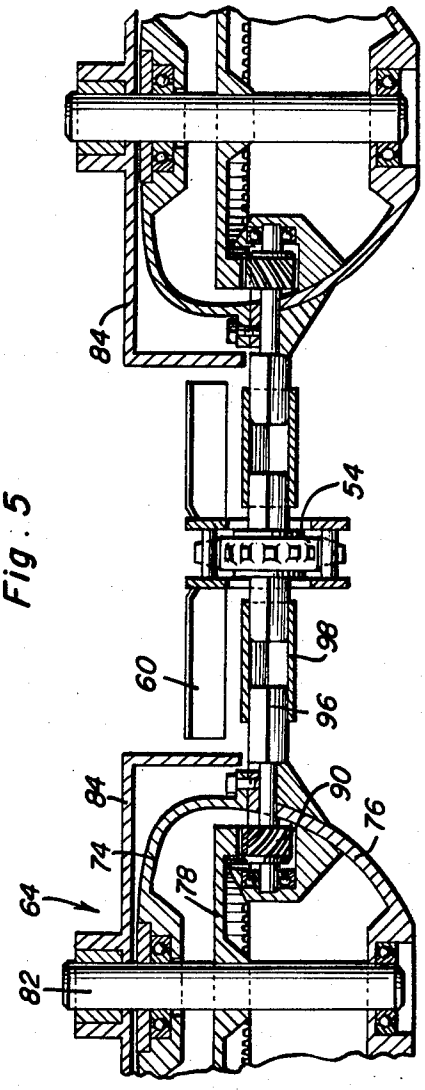


Fig. 5



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COAL LOADER

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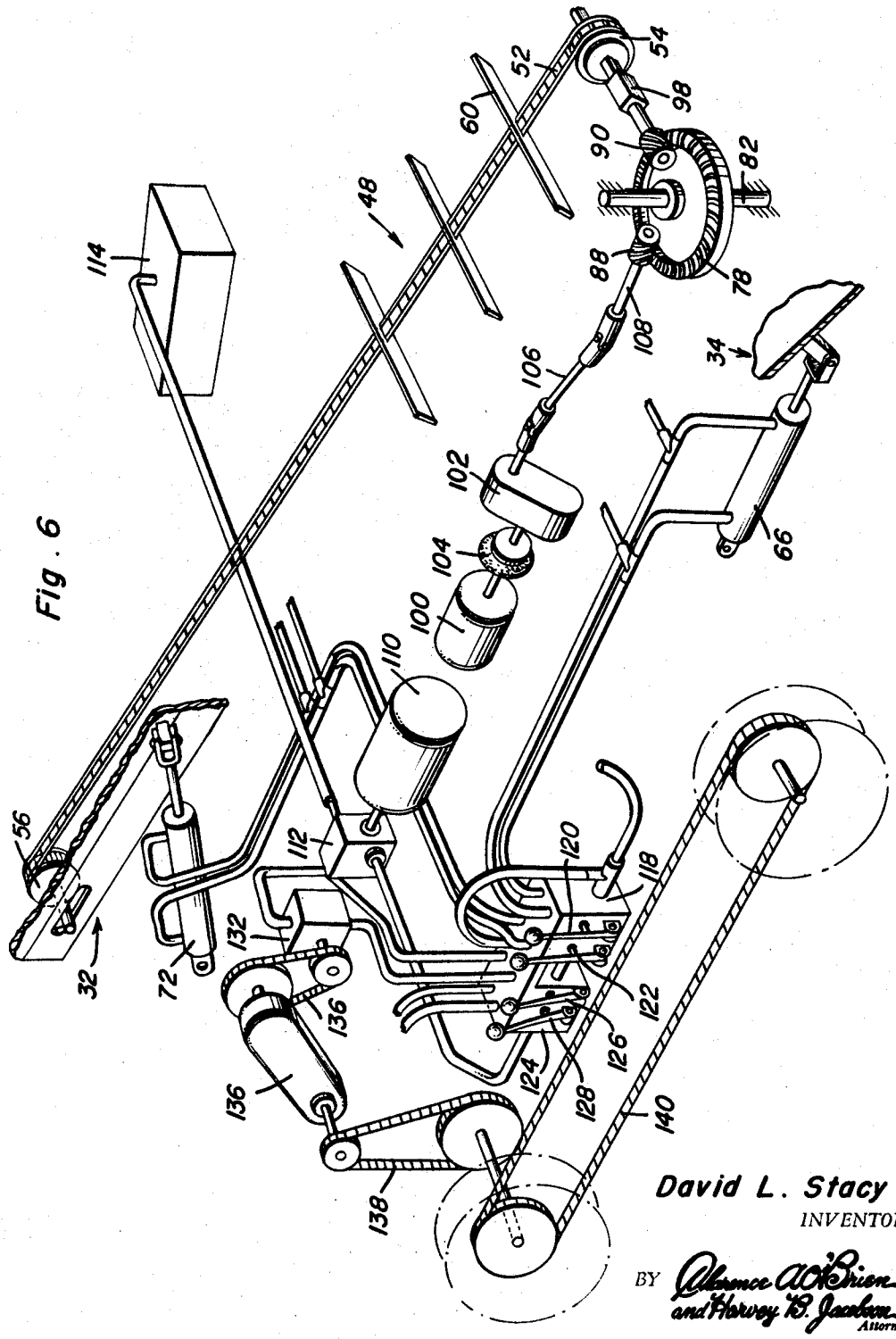

Fig. 6

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United States Patent Office

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COAL LOADER

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Filed May 19, 1967, Ser. No. 639,906
4 Claims. (Cl. 198—9)

ABSTRACT OF THE DISCLOSURE

A mining machine for loading coal into a collection bin by means of a boom mounted conveyor extending rearwardly and upwardly from a lowered loading head from which the coal is displaced onto the conveyor by a pair of rotating loading arms that overlap the conveyor. The boom and head are pivotally mounted on a low height vehicle frame supported by rubber tired wheels driven by fluid motors. Separate drive motors operate the loading arms which are synchronized by a connecting drive that also operates the conveyor.

This invention relates to mining machines and more particularly to a coal loading vehicle propelled to a desired location within a mine so as to scoop coal particles onto a loading head from which they are displaced by rotating arms onto a conveyor, the conveyor transporting the coal to a rearward location from which it is deposited into a collection bin.

It is sometimes desirable to provide a coal loading machine of the aforementioned type which is of a relatively low height and small size for use in mines and at locations where space is very limited. Such a machine must also be capable of withstanding rough treatment and have a heavy duty capability. Also, the machine must be capable of being self-propelled and easily maneuvered without disturbance to the bottom of the mine.

In accordance with the present invention, a relatively small and low coal-loading vehicle is provided wherein a loading head extends forwardly from the vehicle and a conveyor boom extends rearwardly therefrom, both being pivotally mounted adjacent the forward end of the vehicle. Hydraulic piston devices are provided for lowering and elevating the head and boom while fluid motors are provided to propel and steer the vehicle frame under control of an operator through readily accessible hydraulic controls. Rubber wheels of the pneumatic type are utilized for propelling the vehicle without tearing up the bottom of the mine within which the vehicle is to be utilized.

The coal loading machine of the present invention also features separate drive transmissions for a pair of rotating loading arms mounted by the head and overlapping the boom mounted conveyor onto which the loading arms displace coal particles for transport to a location rearwardly of the loading vehicle. The drive transmissions for imparting rotation to the loading arms include shock-absorbing, shaft couplings of the yieldable type in order to avoid rupture of the transmission parts in the event of any overload. A positive drive however interconnects the loading arms for synchronization purposes as well as to impart movement to the boom-mounted conveyor driven at its lower end between the loading arms.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a top plan view of a coal loading machine constructed in accordance with the present invention.

FIGURE 2 is a side elevational view of the machine shown in FIGURE 1.

FIGURE 3 is an enlarged transverse sectional view taken substantially through a plane indicated by section line 3—3 in FIGURE 2.

FIGURE 4 is an enlarged partial sectional view taken substantially through a plane indicated by section line 4—4 in FIGURE 1.

FIGURE 5 is an enlarged partial sectional view taken substantially through a plane indicated by section line 5—5 in FIGURE 1.

FIGURE 6 is a schematic perspective view showing the operative interrelationship of various components associated with the coal loading machine.

Referring now to the drawings in detail, FIGURES 1 and 2 illustrate the entire coal loading machine generally referred to by reference numeral **10**. The machine includes a vehicle frame generally denoted by reference numeral **12** which is rectangular in shape including an outer frame having the side portions **14** and **16** interconnected at the forward end by a front portion **18**. Rear end portions **20** and **22** are formed at the rear end of the outer frame interconnected by the angle frame member **24**. Posts **26** and **28** extend upwardly from the outer frame laterally spaced from each other on either side of the longitudinal axis of the machine so as to support guard rails **30** between which a boom assembly **32** extends upwardly from the forward end of the vehicle frame at which location it is pivotally mounted thereon. Also pivotally mounted by the vehicle frame adjacent its forward end, is a head structure generally denoted by reference numeral **34**. Supporting platforms **36** and **38** extend between the forward and rear ends of the vehicle frame for supporting various operating components of the machine thereon as will be hereafter described. Rubber tired wheels **40** are rotatably mounted by the vehicle frame for support thereof above the ground adjacent the rear and forward ends. Four such wheels are illustrated which project downwardly from the vehicle frame between the supporting platforms **36** and **38** and the side portions **14** and **16** of the outer frame as more clearly seen in FIGURE 1.

The head assembly **34** includes a top deck portion **42** from which side portions **44** depend downwardly so as to pivotally mount the head assembly about an axis established by the pivot shaft **46** extending between the side portions **14** and **16** of the outer frame adjacent the forward end of the vehicle. Also pivotally mounted by the pivot shaft **46**, is the forward end of the boom **32** from which the lower end of a conveyor assembly **48** projects into the cut-out **50** formed in the deck **42** of the head assembly. The conveyor assembly includes an endless conveyor chain **52** entrained about a drive sprocket assembly **54** at the lower end and a driven sprocket assembly **56** at its upper end with which a chain tightening adjuster **58** is associated. Pusher elements **60** are secured to the conveyor chain at spaced locations therealong for upward movement of coal particles along the floor **62** of the boom assembly. The particles are displaced onto the conveyor from the deck **42** of the head assembly by means of a pair of rotating arm assemblies **64** rotatably mounted by the head assembly on opposite lateral sides of the lower end of the conveyor assembly **48**.

As more clearly seen in FIGURE 4, the head assembly **34** when in a lowered position forms a scoop onto which coal particles are displaced by forward movement of the vehicle. A ground-engaging plate portion **64** extends rearwardly from the forward end of the deck **42** therebelow in order to limit downward movement of the head assembly to its lowered position by means of the hydraulic piston assembly **66**, the opposite ends of which are pivotally connected to the head assembly below the deck **42** and the forward end portion **18** of the frame. The

boom assembly **32** on the other hand is displaced between an elevated operative position as shown in FIGURE 2 with the rear delivery end **68** above a collection bin **70** and an inoperative lowered position by means of a pair of hydraulic piston cylinder devices **72** the opposite ends of which are pivotally connected to the frame portions **20** and **22** and the sides of the boom assembly. Thus, the coal loading machine may be conditioned for transport purposes. In the transport position, the head assembly **34** is elevated as shown by dotted line in FIGURE 2 while the boom assembly **32** may be lowered. In an operative condition, the head assembly is lowered to the position illustrated while the boom assembly is elevated so that its delivery end **68** may deposit coal into the collection bin.

With continued reference to FIGURE 4, it will be observed that each of the loading arm assemblies **64** includes upper and lower sections **74** and **76** of an oil filled gear casing having bearings **78** and **80** rotatably supporting a driven shaft **82** to which a face gear **84** is secured within the gear casing. Also splined to the upper projecting end of the shaft **82**, in enclosing relation to the upper section **74** of the gear casing, is a rotating housing **84** to which a pair of displacing arms **86** are secured in 180° relation to each other. The gear casing sections **74** and **76** are bolted to each other and secured to the deck **42** of the head assembly and also rotatably mount therewithin a pinion gear **88** in constant mesh with the face gear **84** for transmitting rotation to the housing **84** and the displacing arms **86** projecting radially therefrom. A second pinion gear **90** meshes with the face gear **78** within the gear casing in 90° relation to the pinion gear **88** as more clearly seen in FIGURE 5.

Input drive is imparted to the loading arm assemblies **64** through the pinion gears **88** by separate transmissions **92** and **94** located on opposite sides of the boom assembly as more clearly seen in FIGURE 1 in order to cause rotation of the coal displacing arms **86** overlapping the lower end of the conveyor assembly **48**. The pinion gears **90** form part of a synchronizing connecting drive between the two loading arm assemblies **64**. Thus, each pinion gear **90** is connected to a shaft section **96** as shown in FIGURE 5 which in turn is coupled to one side of the drive sprocket assembly **54** by means of a tubular coupling sleeve **98** of noncircular cross-section. Thus, the face gears **78** associated with the loading arm assemblies must rotate at the same speed in opposite directions preserving the out-of-phase relationship of the coal displacing arms **86** so as to avoid any interference therebetween. Power is however yieldably and separately transmitted to each of the loading arm assemblies by the transmissions **92** and **94**. Each transmission includes an electric drive motor **100** drivingly connected to the input side of a reduction gear assembly **102** by a yieldable shaft coupling **104**. Shaft couplings of this type are well known and are arranged to accommodate any misalignment between shaft sections as well as to absorb torsional vibration by storing and releasing energy during the transmission of torque between adjacent shaft sections. This form of flexible shaft coupling is disclosed for example in U.S. Pat. No. 2,648,958 and includes an elastically flexible member permanently clamped to rigid disks splined to the ends of the shaft sections so that torque is transmitted with substantially no loss of energy between the shaft sections. The output sides of the reduction gear assemblies **102** are connected through universal shaft assemblies to the pinion gears **88**, the shaft assemblies including pivoted shaft sections **106** and **108** as shown in FIGURE 4.

A prime mover in the form of a relatively large electric motor **110** is mounted on the platform **38** of the vehicle frame on one side of the boom as shown in FIGURE 1, this motor being coupled to a fluid pump **112**. The suction side of the pump is connected to a fluid reservoir tank **114** mounted between the forward and rear wheels on the side of the boom opposite the motor **110** while the pressure output side of the pump is connected to a control valve assembly **116** mounted by the side portion **16** of the frame. The control valve assembly includes a valve section **118** having a pair of manual valve actuator controls **120** and **122** through which the fluid piston devices **66** and **72** are respectively controlled in order to lower or raise the head assembly **34** and boom **32**. The pressure discharge side of the pump **112** is also connected to the other valve section **124** of the control valve assembly with which the control handles **126** and **128** are associated. The control valve handles **126** and **128** accordingly control operation of a pair of fluid motors **130** and **132** of the rotary type respectively supported on the platforms **36** and **38** on opposite lateral sides of the boom adjacent the rear end of the frame. The fluid motors **130** and **132** propel and steer the vehicle.

The output shaft associated with each fluid motor **130** and **132** is drivingly connected to a reduction gear assembly **134** through a sprocket drive **136** while the output side of the reduction gear assembly is drivingly connected by the sprocket drive **138** to the rear wheels. A connecting sprocket drive **140** interconnects the rear and forward wheels for simultaneous rotation. Each wheel is rotatably mounted on a stationary axle **142** secured by a lock plate **144** to the side frame portions **14** and **16** as more clearly seen in FIGURE 2.

Electrical energy is brought to the machine from an external source by means of an electrical cable **146** secured to the rear end of the vehicle by a clamp **148** so as to prevent undue tension from being applied to the cable. The electrical cable is wired to the drive motors **100** and motor **110** through a control switch **150** for regulating operation of the prime mover motor **110** and a push button switch assembly **152** for regulating operation of the drive motors **100**. Associated with the push button switch **152**, is a starting box **154** by means of which starting and stopping of the motors **100** is effected and de-energization of the motors is automatically effected under overload conditions. Starting control boxes of this type are well known such as one manufactured by Westinghouse Corporation, referred to by catalog No. 11200k2cnn.

From the foregoing description, and with reference to FIGURE 6, the arrangement of parts and operation of the machine will be apparent. It will be appreciated therefore, that because of the pivotal mounting of the head assembly **34** and boom assembly **32** adjacent the forward end of the vehicle frame, it may be moved to a desired location through mines having very little head room. Further, because of the use of rubber tires, a minimum disturbance to the floor of the mine will be effected. Also, operation of the machine from one side thereof through the control valve assembly **116** may be accomplished in a facile manner and without requiring any great skill. Coal displacing operation of the loading arm assembly **64** and the conveyor **48** may be effected by drive transmission trains which are independent of the propelling and steering drives for the vehicle frame. By use of separate drives for the respective loading arm assemblies, relatively heavy loads may be accommodated without any danger of breakage to the transmission parts because of overload. Toward this end, the yieldable couplings **104** are utilized and the loading arm assemblies synchronized by a connecting drive which also operates the conveyor **48**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In a loading machine having a frame, pneumatic wheels supporting the frame, a rearwardly extending boom, a forwardly extending loading head, a pair of loading arms rotatably mounted by the head on opposite

lateral sides of the boom, a conveyor mounted by the boom, drive means for rotating the loading arms and operating the conveyor comprising a pair of drive motors, a pair of yieldable coupling means continuously connected between said drive motors and the loading arms, synchronizing drive means interconnecting said loading arms and driving the conveyor within the loading head, and a propelling motor drivingly connected to the pneumatic wheels independently of said drive motors, each of said coupling means including adjacent shaft sections and an elastically resilient member permanently connected between the adjacent shaft sections to absorb torsional vibrations by storing and releasing energy while transmitting torque with substantially no loss of energy.

2. In a loading machine having a wheeled frame, a rearwardly extending boom, a forwardly extending loading head, means pivotally mounting the boom and the loading head on the frame adjacent a forward end thereof, fluid operated devices mounted by the frame adjacent said forward end and a rear end for elevating and lowering said boom and head respectively, a pair of loading arms rotatably mounted by the head laterally of the boom, a conveyor mounted on said boom extending beyond said forward and rear ends of the frame, pneumatic traction wheels rotatably mounted by said frame rearwardly of the pivotal mounting means and projecting thereabove on opposite lateral sides of the boom, a power operated drive mechanism for operating the fluid operated devices, the loading arms and propelling the frame, said drive mechanism comprising a pair of drive motors fixedly mounted by the frame on opposite lateral sides of the boom, a pair of torsionally yieldable transmissions drivingly connecting the drive motors to the loading arms, positive synchronizing drive means interconnecting the loading arms and drivingly connected to the coneveyor for operation thereof, a prime mover mounted by the frame on one lateral side of the boom, propelling means energized by the prime mover for rotating the traction wheels to propel and steer the frame, and control means operatively connecting the prime mover to the propelling means and the fluid operated devices, said prime mover including a motor driven pump on said one lateral side of the boom, a reservoir of fluid mounted by the frame on the other side of the boom, and fluid conduits connecting the reservoir to the pump and the pump to the control means on said one side of the boom.

3. In a loading machine having a wheeled frame, a rearwardly extending boom, a forwardly extending loading head, means pivotally mounting the boom and the loading head on the frame adjacent a forward end thereof, fluid operated devices mounted by the frame adjacent said forward end and a rear end for elevating and lowering said boom and head respectively, a pair of loading arms rotatably mounted by the head laterally of the boom, a conveyor mounted on said boom extending beyond said forward and rear ends of the frame, traction wheels rotatably mounted by said frame rearwardly of the pivotal mounting means and projecting thereabove on opposite lateral sides of the boom, a power operated drive mechanism for operating the fluid operated devices, the loading arms and propelling the frame, said drive mechanism comprising a pair of drive motors fixedly mounted by the frame on opposite lateral sides of the boom, a pair of independent transmissions drivingly connecting the drive motors to the loading arms, synchronizing drive means interconnecting the loading arms and drivingly connected to the conveyor for operation thereof, a prime mover mounted by the frame on one lateral side of the boom, propelling means energized by the prime mover for rotating the traction wheels to propel and steer the frame, and control means operatively connecting the prime mover to the propelling means and the fluid operated devices, said prime mover comprising an electric motor, a pump driven by the motor on said one side of the boom, a reservoir of fluid mounted by the frame on the other side of the boom between the wheels and fluid conduits connecting the reservoir to the pump and the pump to the control means on said one side of the boom between the wheels.

4. The combination of claim 3 wherein each of said independent transmissions includes a reduction gear assembly, yieldable coupling means connecting the gear assembly to one of the drive motors and a universal shaft assembly drivingly connecting the gear assembly to one of the loading arms.

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