Dec. 13, 1927.

1,652,358

H. J. HEIDER

TRACTOR

Filed April 13, 1922

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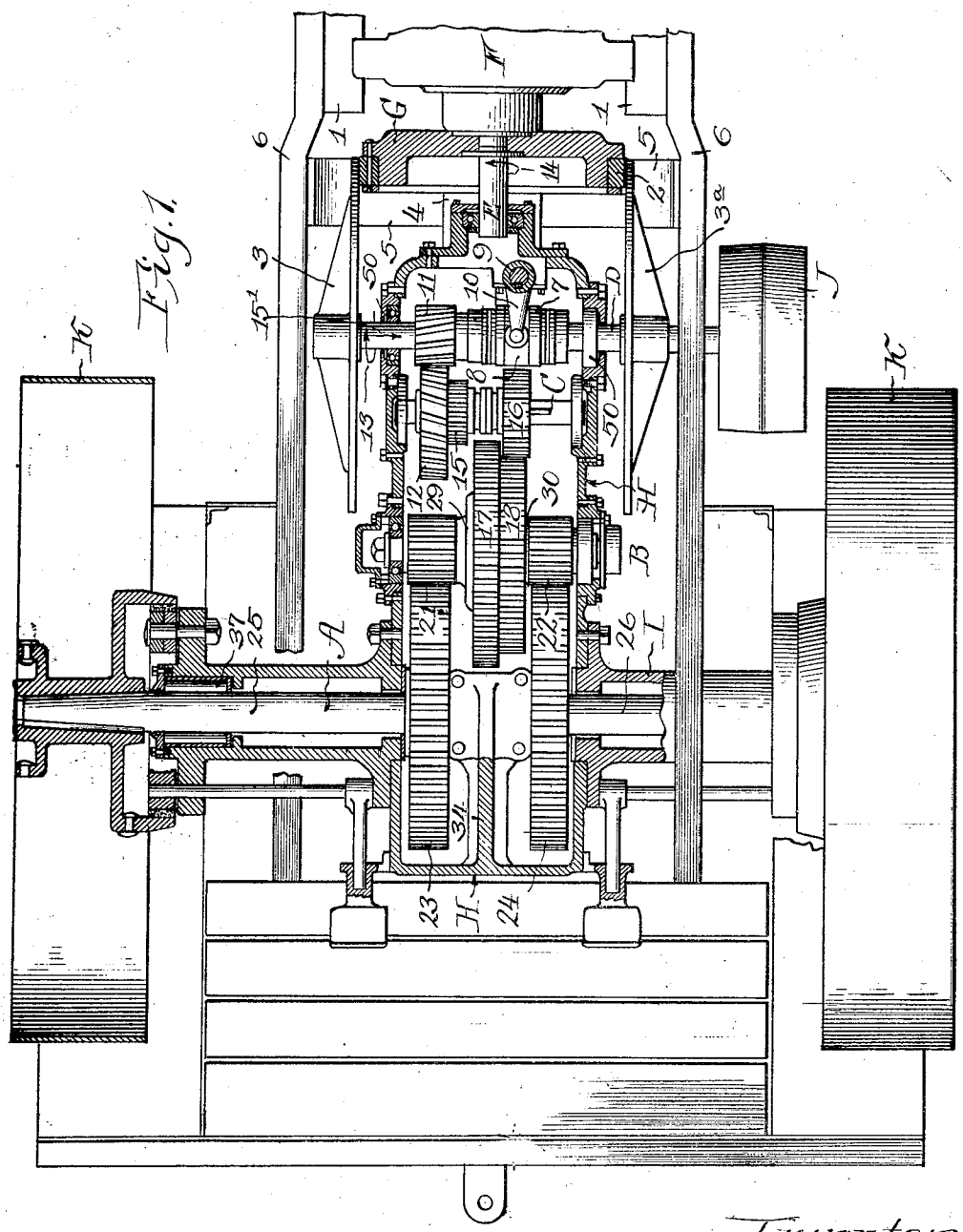


Fig. 1.

Witness:
Chas. R. Knorsl.

Inventor,
Henry J. Heider.
By Chas. L. Bulkley, Attys.

Dec. 13, 1927.

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H. J. HEIDER

TRACTOR

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Fig. 3

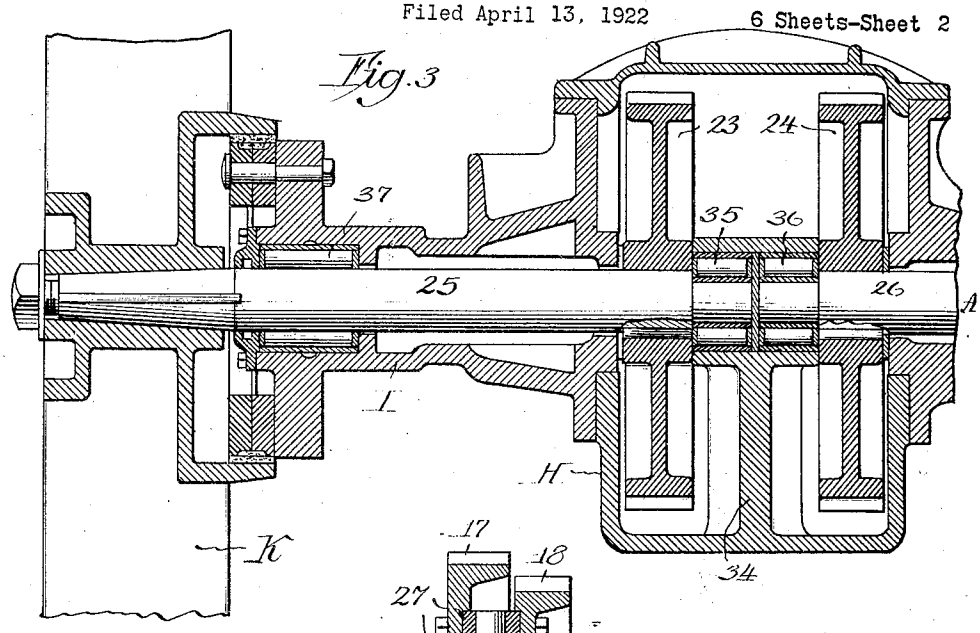


Fig. 2

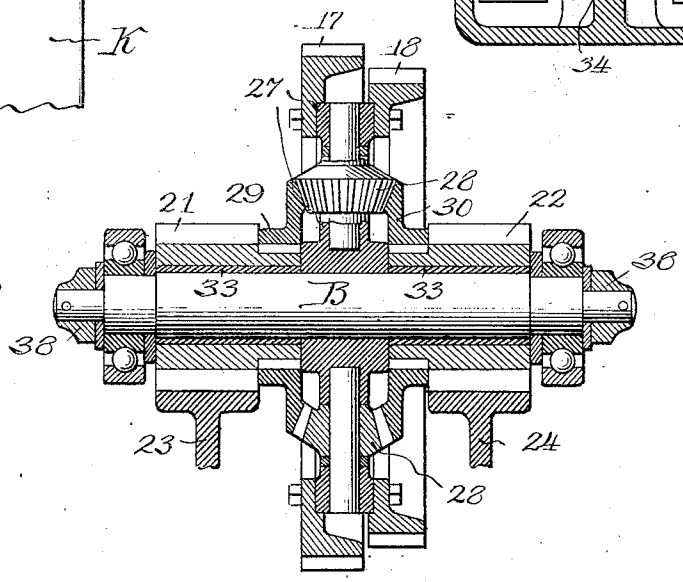


Fig. 4

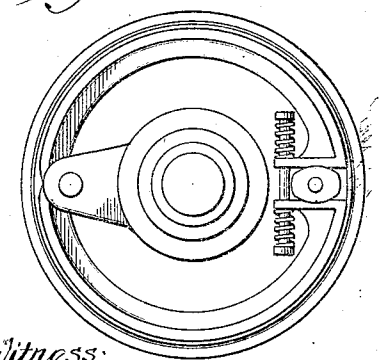
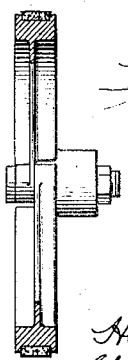


Fig. 5



Witness:
Chas. R. Kousek

Inventor,
Henry J. Heider,
By Chas. C. Bulkley, Attys

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H. J. HEIDER

TRACTOR

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Fig. 7

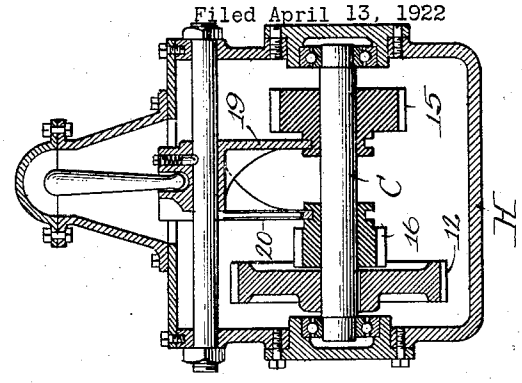
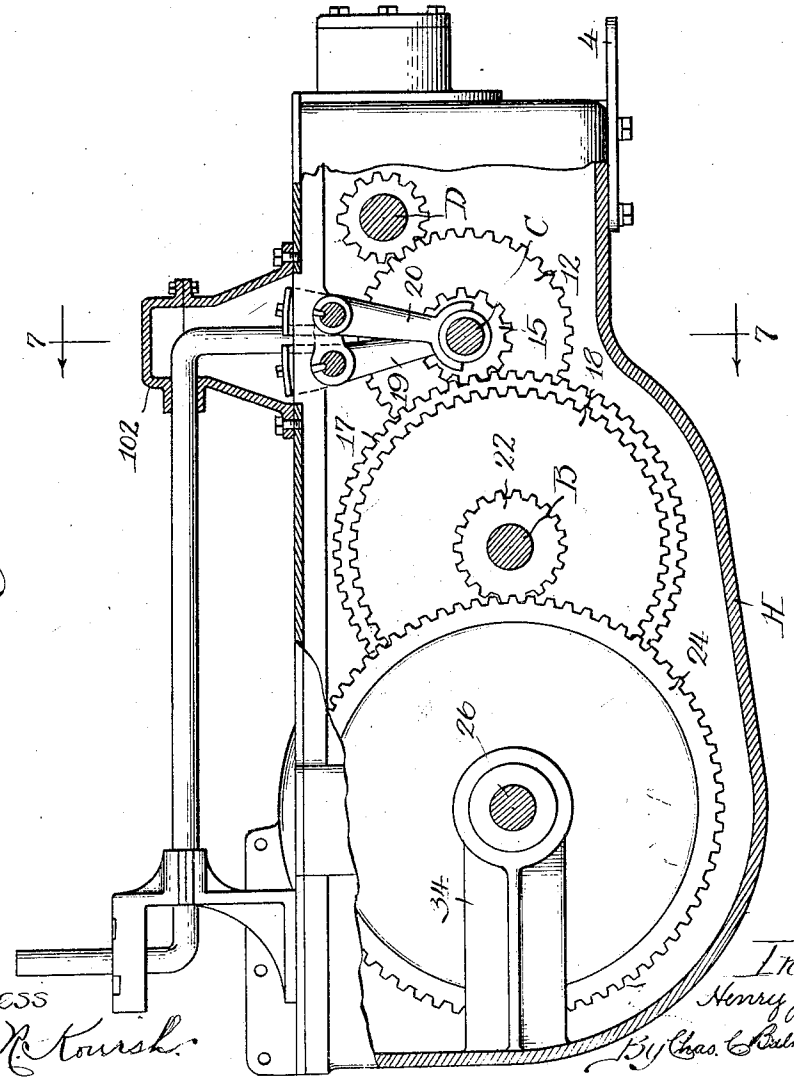


Fig. 6



Witness
Chas. R. Kourek.

Inventor,
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By Chas. E. Bulkley & Alley

Dec. 13, 1927. 1,652,358

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TRACTOR

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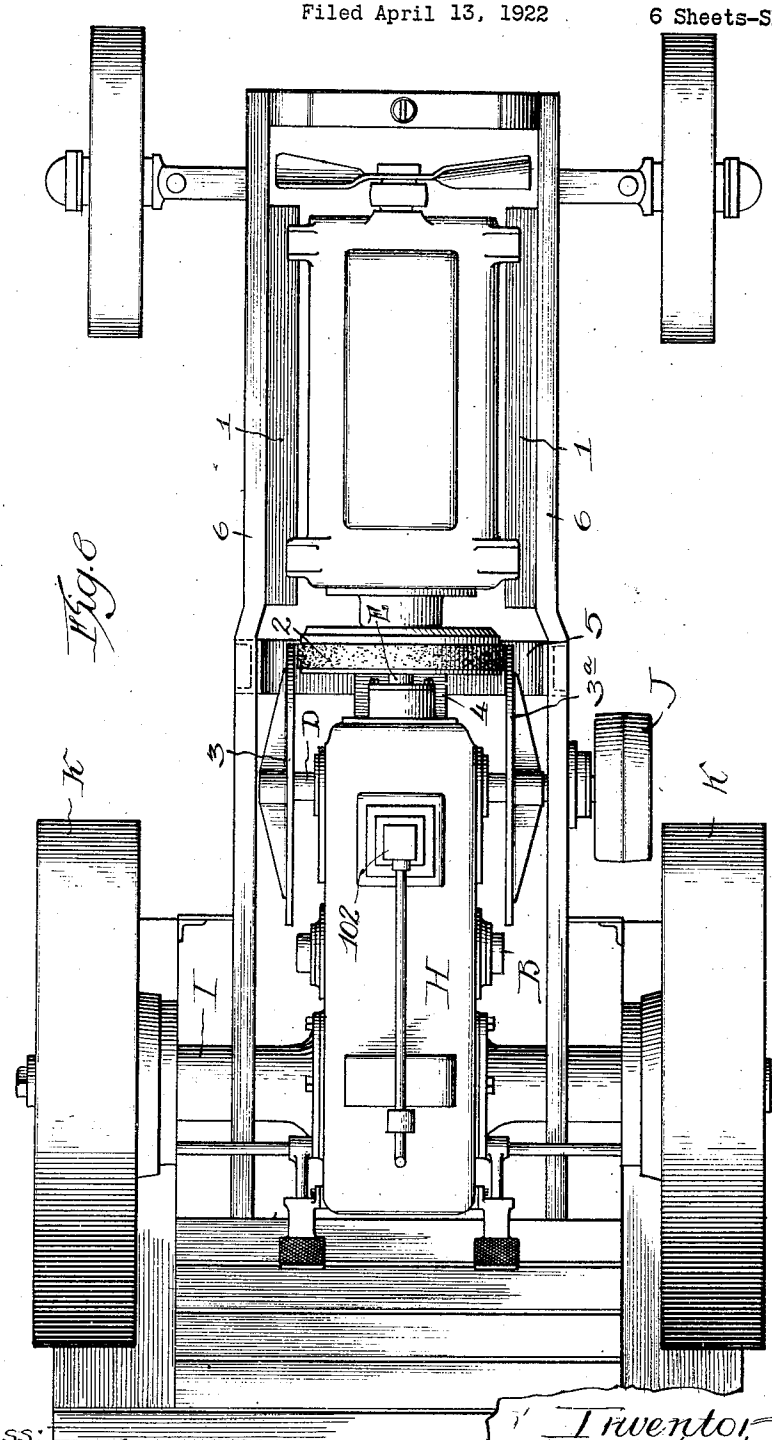


Fig. 6

Witness:
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Inventor,
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Atty

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TRACTOR

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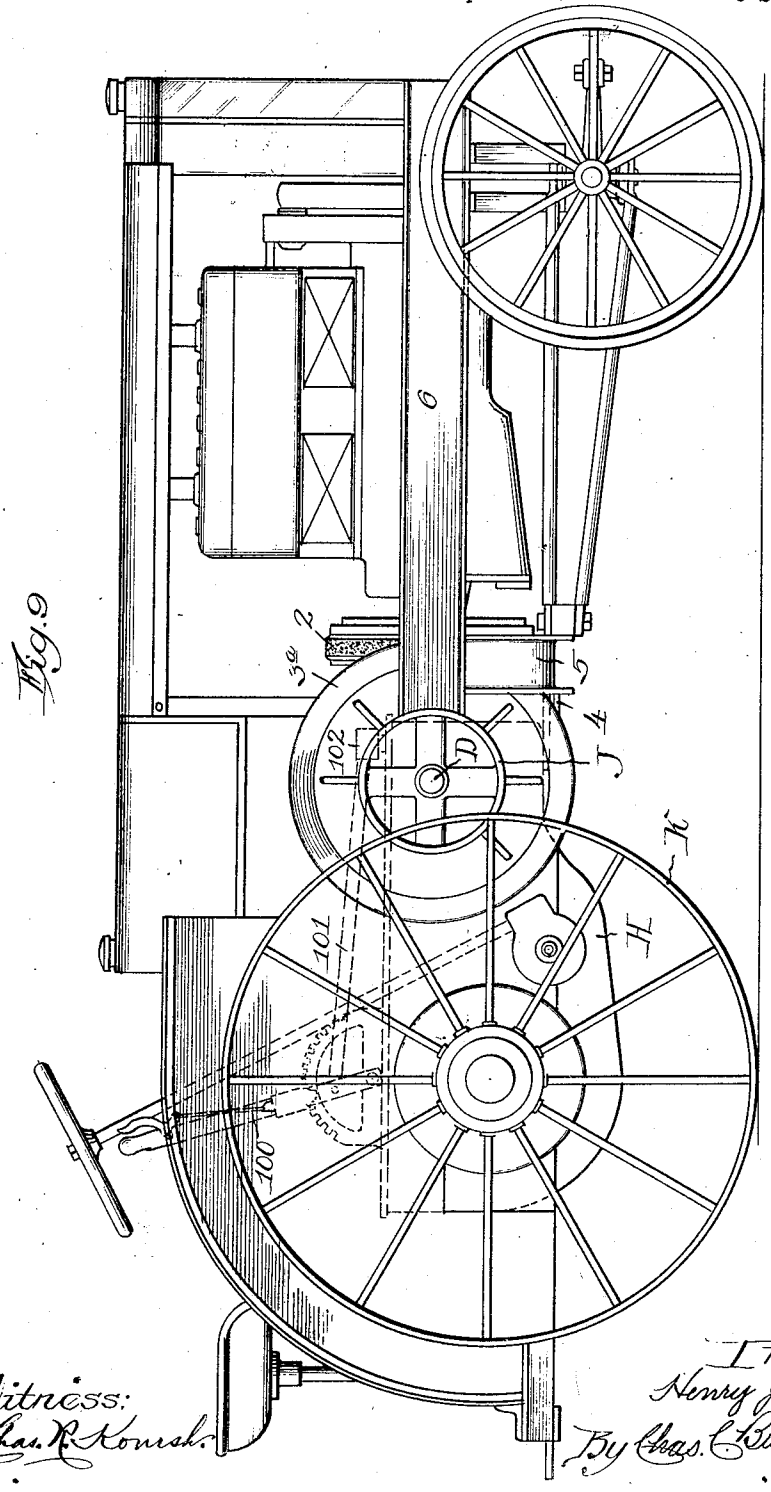


Fig. 9

Witness:
Chas. R. Kourish.

Inventor,
Henry J. Heider,
By Chas. C. Bulkley, Attys

Dec. 13, 1927.

1,652,358

H. J. HEIDER

TRACTOR

Filed April 13, 1922

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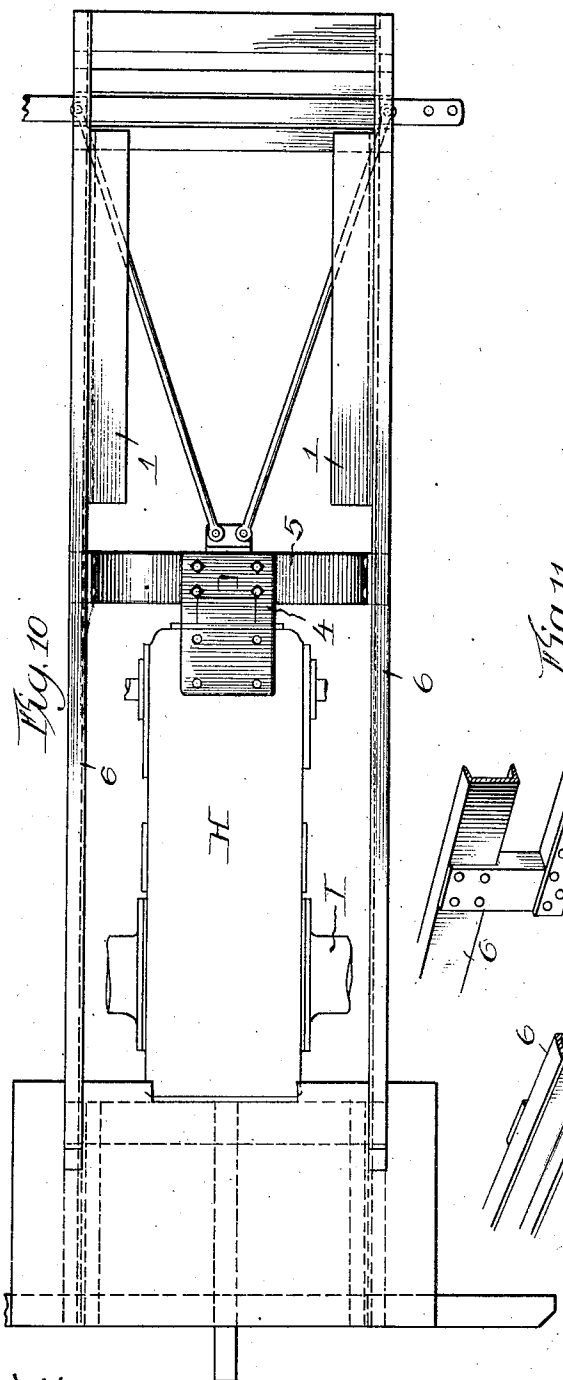


Fig. 10

Fig. 11

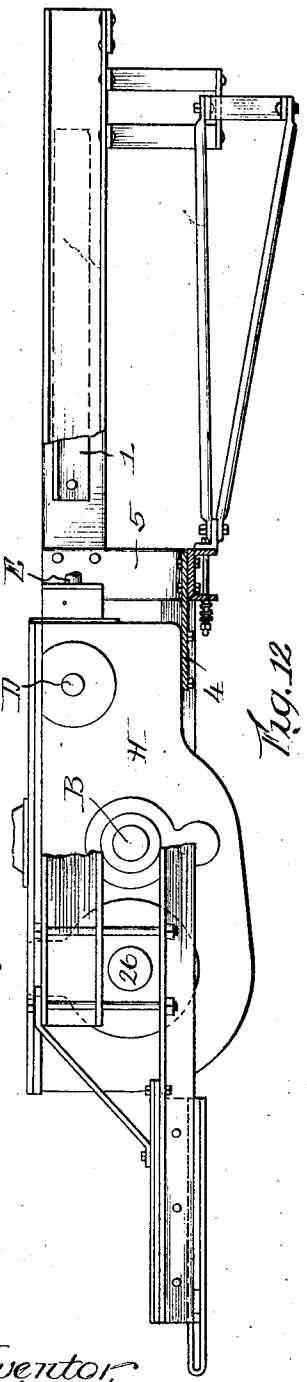


Fig. 12

Witness:
Chas. K. Kourek.

Inventor,
Henry J. Heider,
By Chas. C. Bulkley.
Attys

Patented Dec. 13, 1927. 1,652,358

UNITED STATES PATENT OFFICE.

HENRY J. HEIDER, OF CARROLL, IOWA, ASSIGNOR TO ROCK ISLAND PLOW COMPANY, OF ROCK ISLAND, ILLINOIS, A CORPORATION OF ILLINOIS.

TRACTOR.

Application filed April 13, 1922. Serial No. 552,427.

My invention is an improved tractor and relates principally to the power transmission means from the engine, the means of supporting the case which incloses the gearing, the construction of the differential and other features of construction illustrated in the drawings and hereinafter described and claimed.

In the drawings—

Figure 1 is a plan view partly in section showing the friction gear and differential.

Fig. 2 is a sectional view of the differential.

Fig. 3 is a view through the rear axle, certain parts being broken away and others in section.

Figs. 4 and 5 are, respectively, an elevation and section of the brake-shoes.

Fig. 6 is a side elevation, partly in section, of the gear case and inclosed gear.

Fig. 7 is a transverse section on the line 7—7 of Fig. 6.

Fig. 8 is a plan view of the structure showing the general arrangement and disposition of the different parts.

Fig. 9 is a side elevation of the complete tractor.

Fig. 10 is a plan view of the frame of the tractor and gear case.

Fig. 11 is a fragmentary perspective view showing the means of supporting the front end of the gear case.

Fig. 12 is a side view of the frame of the tractor and gear case.

The engine F with its shaft E and flywheel is movable longitudinally of the frame upon ways 1. The flywheel is utilized as a friction transmission wheel and for this purpose is provided upon its periphery with a fibre friction band 2 adapted to cooperate with either of the steel friction discs 3 or 3ª. By means of the longitudinal adjustment of the engine, which may be effected by a lever convenient to the driver and suitable connections such as shown in my prior Patent No. 1,154,767, granted September 28, 1915, the flywheel may be made to frictionally engage the friction discs near their periphery or centers or at intermediate points, thus establishing any desired speed ratio between the engine crank shaft E and the friction disc shaft D.

The friction disc shaft D together with the differential and all other gearing is mounted and inclosed in a gear case H. At its rear end the gear case is supported on the rear axle housing 1 and at its front end by means of a relatively thin plate 4 bolted or otherwise secured to the bottom of the front end of the gear case and to the top of the cross member 5, the upwardly projecting ends of which are secured to the side sills 6, 6 of the frame. There is sufficient flexibility in the relatively thin plate 4 to relieve the gear case of excessive strains and to prevent the transmission of such strains through the gear case to the rear axle or in the opposite direction.

The shaft D carries both of the friction discs 3, 3ª and the power take-off pulley, J, all of which are keyed in fixed relation thereto. Ball bearings 50 support shaft D in the side walls of the gear case. The friction discs 3 and 3ª are positioned on shaft D with their friction faces separated by a distance slightly greater than the diameter of the fibre friction ring 2 on the periphery of the friction flywheel, and the shaft D is movable in the direction of its axis to an extent sufficient to bring either of the friction discs 3, 3ª into engaging frictional contact with the fibre ring 2 or, when in an intermediate position to hold both of said friction discs free of the fibre ring. Provision is thus made for transmitting power to rotate shaft D in either direction or to disconnect said shaft from the engine. A ring 8 is rotatably mounted in a groove in a collar 7 fixed to shaft D. Fixed to vertical shaft 9, is an arm 10 having pivotal connection with ring 8, thus affording means by a slight rotary movement of shaft 9 for bringing either of the discs 3, 3ª into engagement with the fibre ring 2 with varying degrees of pressure or for holding both discs out of engagement therewith. This adjustment to forward, reverse or neutral, may be effected by any suitable operating connections extending from shaft 9 to a point convenient to the driver, the shift lever 100 being shown in Fig. 9 and also the bar 101 connecting the shift lever to shaft 9.

Power is transmitted from the friction gear shaft D to intermediate or jack shaft C by means of spiral gears 11, 12 fixed to said shafts, the spiral gear 11 being of ample thickness to preserve the mesh with gear 12 in the different longitudinal adjustments of shaft D. Power is transmitted to the rear wheels through gear 12. One of the prin-

cipal requisites for the most efficient transmission of power by friction gears is the adjustment of the pressure between the coacting friction members at that point where there will be neither slippage with consequent failure to transmit all of the power nor excess pressure over and above that necessary to prevent slippage, which excess pressure also would cause loss of power by its absorption in the useless work of overcoming the friction caused by the excess pressure. By the use of spiral gears or equivalent means of transmission producing an end thrust upon the friction disc shaft D, I vary the pressure between the friction discs 3, 3ª and the fibre ring 2 in proportion to the amount of power which is transmitted. By reason of the inclination of spiral gear teeth to the axis of the gear, transmission of power through such gears sets up an end thrust in the shafts upon which the gears are mounted and this end thrust is of course proportional to the pressure upon the gear teeth, the end thrust being a component of that pressure. The magnitude of the end thrust is dependent upon and varies with the inclination of the teeth to the axes of the gears, the greater the inclination the greater being the end thrust.

As illustrated in the drawing, the engine shaft turns in the direction indicated by the arrow 14, thus transmitting to the friction disc 3, which is shown in engagement with fibre ring 2, rotation in the direction indicated by the arrow 13, with a resulting end thrust upon shaft D in the direction indicated by the arrow 15′, thus setting up between the friction disc 3 and the fibre ring 2 pressure which is directly proportional to the pressure between the teeth of spiral gears 11 and 12 and hence proportional also to the power being transmitted. When the traction wheels K, K encounter increased resistance, thereby causing increased resistance to the rotation of gears 11 and 12, slippage of the friction gears is automatically prevented by reason of the fact that the increased resistance causes increased pressure between the teeth of the spiral gears, thus increasing the end thrust in shaft D with a proportional increase in the pressure between friction disc 3 and fibre ring 2.

When the friction drive is set for rotation of shaft D in the direction opposite to that indicated by the arrows, i. e. with friction disc 3 disengaged and disc 3ª engaged with fibre ring 2, the end thrust in shaft D will be opposite to the direction indicated by arrow 15′ and pressure will be caused and automatically regulated between friction disc 3ª and fibre ring 2 as above described in connection with the transmission of power through disc 3.

Two spur gears 15 and 16 of different diameters are slidably and non-rotatably mounted on the jack-shaft C and adapted to be moved one at a time into engagement respectively with differential gears 17 and 18 or to be both moved out of engagement with the differential. The gear shifting mechanism is shown in section in Figure 7. The gears 15 and 16 have hubs in which there are formed annular grooves engaged respectively by the gear shifting members 19 and 20 with which suitable interlocking mechanism is connected to insure engagement of only one of the gears at a time with a differential gear or disconnection of both therefrom.

The speed changes obtainable by moving the fly wheel G with its fibre friction ring toward and from the center of the friction discs 3 and 3ª gives a sufficient range for either traction duty or for travel without heavy traction effort. It is desirable, however, to provide means for obtaining a higher speed ratio between the traction wheels and engine to be used in road travel or whenever traction is less necessary than speed. It is for this reason that I provide the differential with the two gears 17 and 18 cooperating with the gear and gear shift mechanism above described.

The differential is shown in section in Figure 2 and the rear axle assembly in Figure 3. As will be observed, the entire differential mechanism is mounted on shaft B and held in assembled relation by means of nuts 38 engaging the ends of said shaft. The differential is a complete, self-contained unit.

The differential gear rings 17, 18 are bolted to the spider or bevel pinion carrier 27 which in turn is centered on shaft B.

Bevel pinions 28 are rotatably mounted on spider 27 and coact with bevel gears 29, 30 which are keyed respectively to spur pinions 21, 22 rotatably mounted on differential shaft B. In operation the spur pinion 21 and its attached bevel gear 29 function as a single element by reason of being shaped together. The same is true of pinion 22 and bevel 30. Bushings 33, 33 upon the shaft B form bearing for the pinions 21, 22. As shown in Figure 1, gears 21, 22 mesh respectively with gears 23, 24 fixed to the axle section 25, 26. A web 34 projecting upwardly from the bottom of the gear case H affords support for roller bearings 35, 36 at the inner ends of the axle sections, the outer ends of which are journaled in roller bearings 37 carried by the axle housing 1. The traction wheels K, K are keyed to the outer ends of the axle sections.

When the traction wheels encounter and transmit equal resistance to gears 23, 24 which in turn then transmit equal resistance to pinions 21, 22 and their attached bevel gear 29, and 30 the differential bevel pinions 28 will revolve bodily with the differential spider 27 without rotation upon their

axes thus causing the divided axle 25, 26 to rotate as a unit. Under these conditions the pinions 21, 22 although free to rotate on shaft B, will rotate therewith at the same angular velocity. If one of the traction wheels, wheel J for instance, encounters greater resistance than the other, thus transmitting a correspondingly greater resistance to bevel gear 29 than that encountered by bevel gear 30, the bevel pinions 28 will revolve on their axes at a rate sufficient to distribute power to the bevels 29, 30 proportionately to the resistance transmitted to them by the tractor wheels. Under these conditions the gears 21, 22 will rotate on bushings 33 relative to shaft B.

What I claim as my invention is:

A power transmission comprising a shaft, a pair of opposing friction disks fixed on said shaft, a friction wheel between and adapted to be engaged by either or neither of said disks, a single spiral gear fixed on said shaft between said disks and a cooperating spiral gear for driving said first named gear, the teeth of said spiral gears being inclined in a direction to set up an end thrust acting to draw either of said disks toward said wheel in closer frictional contact with the latter, and means for bodily shifting said shaft, its disks and its gear longitudinally of the other gear.

Signed by me at Rock Island, Ill., this 22 day of March, 1922.

HENRY J. HEIDER.