L. H. THULLEN.

FEEDING DEVICE.

APPLICATION FILED MAY 20, 1915.

1,221,391. Patented Apr. 3, 1917.

Fig. 1

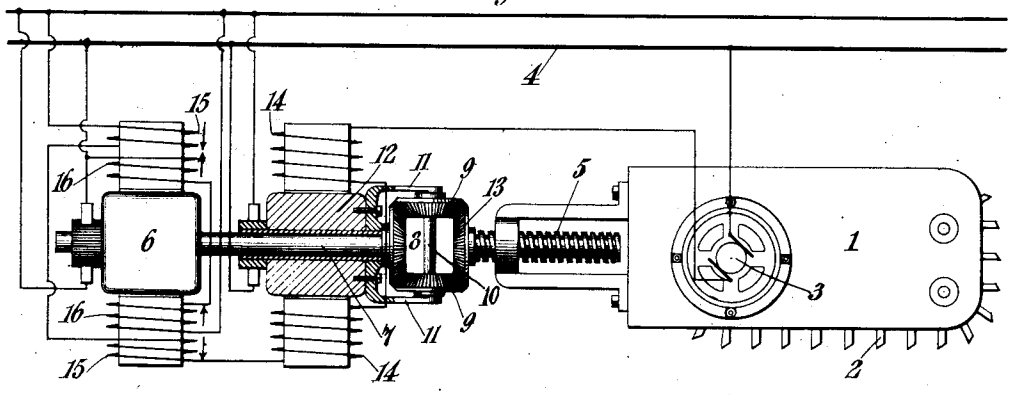


Fig. 2

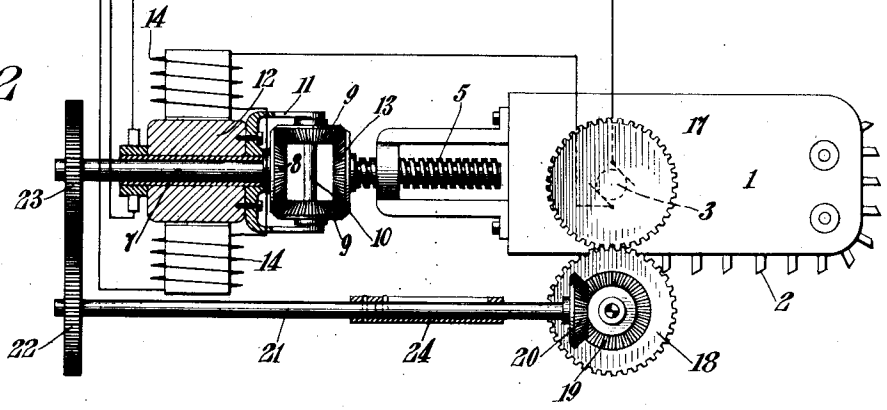
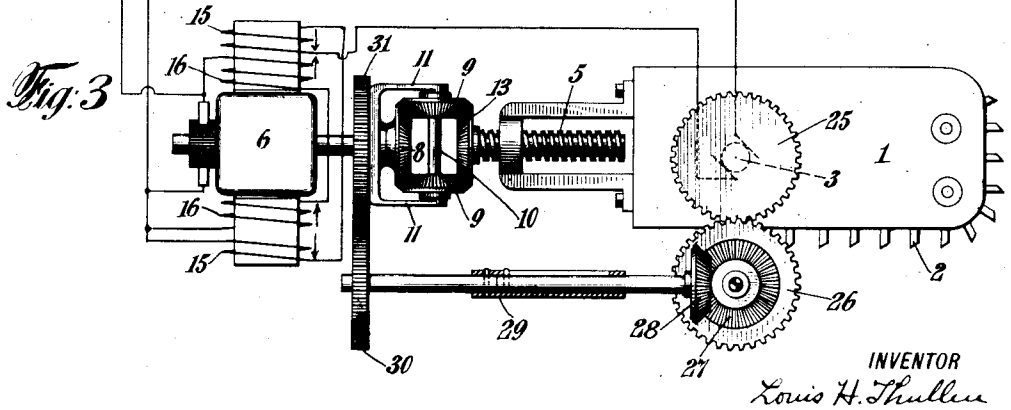


Fig. 3



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FEEDING DEVICE.

1,221,391. Specification of Letters Patent. Patented Apr. 3, 1917.

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To all whom it may concern:

Be it known that I, LOUIS H. THULLEN, a citizen of the United States, and a resident of Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Feeding Devices, of which the following is a specification.

The invention relates to improvements in feeding devices and is more particularly adapted to be used in connection with coal cutters, although it is adapted to other uses. One object of this invention is to provide an improved simple and efficient arrangement by which the feed of the cutter or other work device is retarded or varied in accordance with the vein of coal being cut or in accordance with increases in load thereon or the resistance offered thereto. Another object is to provide an arrangement whereby when the resistance offered becomes too great, the feed will be reversed until the resistance offered becomes such that forward feed may again properly take place. Further objects, features and advantages will more clearly appear from the detailed description given below taken in connection with the accompanying drawing which forms a part of the specification. In the drawing Figure 1 illustrates diagrammatically an arrangement embodying the invention in one form, as applied to a coal cutter. Figs. 2 and 3 are similar views showing modifications.

Referring to Fig. 1, the character 1 represents a coal cutter intended to be fed forward into the coal beds for the purpose of cutting the coal out. Any suitable cutting device may be employed. The one shown is provided with cutting teeth or knives 2. For operating the cutter, an electric motor is provided at 3, supplied with current from the mains 4. A screw 5 feeds the cutter and to operate the screw 5, the following mechanism is shown. An electric motor 6 operates a shaft 7, to which is attached a bevel gear 8 meshing with the planetary gears 9 on the stud shaft 10, the shaft 10 being carried by a forked frame 11 secured to the armature of another electric motor 12, whereby rotation of the motor 12 produces a planetary movement of the gears 9. The shaft 7 passes centrally through the armature of the motor 12, but rotates independently thereof in order that the gear 8 may be rotated by the motor 6 independently of the planetary movement of the gears 9, although in mesh therewith. Opposite the gear 8 and secured to the screw shaft 5 is a bevel gear 13 meshing with the planetary gears 9. The field coils 14 of the motor 12 and the field coils 15 of the motor 6 are arranged in series with the motor 3, so that any variation of current taken by the motor 3 is felt in these field coils. The motor 6 is provided with the field coils 16, the coils 15 being wound to oppose the field set up by the coils 16.

Assuming that all the gears of the differential gearing 8, 9, 13 are of the same pitch diameter, it will be seen that if the motors 6 and 12 are running at the same speed and in the same direction, the differential and all the gears thereof will turn as a complete unit about the axis of the shafts 5 and 7 and so turn the screw shaft 5 and feed the cutter at a definite speed, the shaft 5 rotating at the same speed as the shaft 7 and motors 6 and 12 in the arrangement shown. Any other intermediate mechanism may be employed for transmitting the feeding motion from the differential to the cutter 1. Should a heavy load fall upon the cutter, making it desirable to feed it more slowly, the increase in current taken by the motor 3, due to the increased resistance offered the cutter, will cause the field strength of motor 12 to be increased, the field coils 14 of motor 12 being in series with the motor 3. This increase of field strength of motor 12 causes it to decrease its speed. The same increase in current acting in the coils 15 of motor 6 cuts down the field strength of the motor, since coils 15 are wound to oppose the main field coils 16 of the motor, thereby causing the motor to increase its speed. This differential action causes the gear 13 to be driven at less speed, and the feed of the cutter to be retarded, and if the speed of the motor 6 be twice that of the motor 12 (assuming the gears 8, 9 and 13 to be all of the same size) the gear 13 will remain stationary and there will be no feed of the cutter 1 or other work device. If the resistance offered the work device be so great as to necessitate a reversal of the feed, the increase of current taken is such as to make the speed of the motor 6 more than twice that of motor 12, causing the gear 13 to rotate in the opposite direction and reverse the feed of the work device. So it is ob-

vious that as the load on motor 3 increases, the rotation of feed screw 5 will become slower and slower until a point is reached when it will cease to rotate, and if this point should be exceeded the screw will start to rotate the other way. Thus by suitably proportioning the windings in the various motors the feed may be caused to be entirely automatic, and should a cutter bind sufficiently to endanger the motor 3, the feed mechanism will automatically reverse and so relieve the strain on the cutter.

It will be seen that the arrangement illustrated embodies a differential gearing 8, 9, 13, one part of said gearing 13 operating the feeding means, a motor 12 for driving another part of said gearing and a motor 6 for independently driving another part of the gearing and connections whereby the field of one motor is strengthened and the field of the other weakened responsive to increases in load upon, or resistance offered, the motor operating the work device, so that the differential action of the motors 6 and 12 acts to retard the feeding means and automatically reverse the feed when the resistance reaches a predetermined value. The motor 3 is preferably of the constant speed type, although any other form of motor or operating device may be used as occasion may require.

The arrangement shown in Fig. 2 is the same as that shown in Fig. 1, except that the motor 6 is omitted and the shaft 7 is driven at substantially constant speed by the motor 3 by means of the gears 17, 18, 19, 20, shafting 21 and gears 22 and 23. The shafting 21 is made extensible by a pin and slot connection 24, so that as the cutter 1 with the motor 3 is fed forward, the mechanical driving connection between the shaft 7 and motor 3 will still be maintained. Any other suitable method of obtaining this result may be utilized. With the arrangement shown in Fig. 2, the differential action is caused wholly by the variations in speed of the machine 12. When its speed is half that of the shaft 7, the feeding ceases, and when the speed of the motor 6 is less than half that of the shaft 7, the feeding is reversed.

In Fig. 3 the arrangement is the same as that in Fig. 1, except that the motor 12 is omitted and the frame 11 carrying the planetary gears 9 is driven from the motor 3 by gears 25, 26, 27, 28, extensible shafting 29, and gears 30 and 31. In this arrangement differential action is caused by the variations in speed of the machine 6, although it will be apparent that if the motor 3 be one which decreases in speed as the load increases, this will vary the speed of the forked frame 11 and planetary gears 9 and so increase the differential action.

Many changes and modifications in the apparatus used to secure the above purposes may be made without departing from the spirit and scope of my invention in its broad aspects as set forth in the following claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination of a motor, a device driven by the motor with a load of varying value, means for feeding the device to its work, differential gearing, one part of said gearing operating the feeding means, a second motor for driving another part of said gearing, a third motor for driving a third part of said gearing, and connections whereby the field of the second motor is strengthened and the field of the third motor is weakened responsive to increases in load on the first motor to retard the feeding means.

2. The combination of a motor, a device driven by the motor with a load of varying value, means for feeding the device to its work, differential gearing, one part of said gearing operating the feeding means, a motor for driving another part of said gearing, means for independently driving another part of said gearing and connections whereby the field of the second motor is varied responsive to the variations in load on the first motor whereby upon an increase of load on the first motor the feeding means is retarded.

3. The combination of a motor, a device driven by the motor with a load of varying value, means for feeding the device to its work, differential gearing, one part of said gearing operating the feeding means, a motor for driving another part of said gearing, means for independently driving another part of said gearing and connections whereby the field of the second motor is strengthened responsive to an increase in load on the first motor to decrease the speed of the second motor, whereby upon an increase of load on the first motor the feeding means is retarded.

4. The combination of a motor, a device driven by the motor with a load of varying value, means for feeding the device to its work, differential gearing, one part of said gearing operating the feeding means, a motor for driving another part of said gearing, means for independently driving another part of said gearing and connections whereby the field of the second motor is weakened responsive to an increase in load on the first motor to increase the speed of the second motor, whereby upon an increase of load on the first motor the feeding means is retarded.

5. The combination of a work device, means for feeding the said device, differential gearing, one part of said gearing operating the feeding means, a motor for driving another part of said gearing, means for independently driving another part of said gearing and connections whereby the field of the motor is varied in accordance

with the resistance offered said work device, whereby upon an increase in resistance offered the work device the feeding thereof is retarded.

6. The combination of a work device, means for feeding said work device and means for driving the feeding means and retarding the feeding of said work device upon increase in resistance offered said work device, said last-mentioned means embracing apparatus which causes the feeding of said work device to be automatically reversed when the said resistance reaches a predetermined value.

7. The combination of a work device, means for feeding the work device, two driving means for said feeding means, the differential action of which acts to drive the feeding means at varying speed, and means controlled by the resistance to said work device for automatically varying the speed of one of said driving means to vary the speed of the feeding means.

8. The combination of a work device, means for feeding the work device, two rotary devices for operating said feeding means, the differential action of which acts to vary the speed of the feeding means, one of said devices comprising an electric motor and means controlled by the resistance to said work device for automatically varying the speed of said motor to vary the speed of the feeding means.

9. The combination of a work device, means for feeding the work device, two driving means for said feeding means, the differential action of which acts to drive the feeding means at varying speed and means automatically varying the speed of one of the driving means to retard the speed of the feeding means and reverse the feed upon the resistance offered the work device reaching a predetermined value.

10. The combination of a work device, means for feeding the work device, two driving means for said feeding means, the differential action of which acts to drive the feeding means at varying speed, a motor for operating the work device and means automatically varying the speed of one of said driving means to retard the feed of the work device responsive to increases in load on said motor.

11. The combination of a work device, means for feeding the work device, two driving means for operating said feeding means, the differential action of which acts to vary the speed of the feeding means, one of said driving means comprising an electric motor, an electric motor for operating the work device and means automatically varying the field strength of said first-mentioned motor to retard the feed of the work device as the load on the second motor increases.

12. The combination of a coal cutter device, a motor for operating the same and differential means for feeding the coal cutter device including means automatically retarding the feeding of the cutter device upon increases in the resistance offered thereto and causing the feeding of the cutter device to be reversed when said resistance reaches a predetermined value.

13. The combination of a coal cutter device, an electric motor operating the same, means for feeding the cutter device, two driving means for said feeding means having a differential action acting to vary the speed of the feeding means, one of said driving means comprising an electric motor and means automatically varying the field strength of said last-mentioned motor to retard the feed of the cutter device and reverse the feed thereof upon the resistance offered the cutter device reaching a predetermined value.

14. The combination of a work device, a shaft carrying a bevel gear and coöperating means adapted to feed said work device, a motor operating the work device while it is being fed, planetary gears driving said bevel gear, another gear coöperating with said planetary gears in the driving of bevel gear, driving means for said planetary gears and said last-mentioned gear respectively, one of said driving means comprising an electric motor and connections whereby the speed of said last mentioned motor is varied automatically upon increases in the resistance offered the work device.

15. The combination of a work device, means for feeding the work device, two electric motors for driving the feeding means and having a differential action to vary the speed of the feeding means and connections whereby the field of one driving motor is strengthened and the field of the other driving motor is weakened to vary the speed of the feeding means responsive to variations in the resistance offered the work device.

16. The combination of a coal cutter device, a shaft carrying a bevel gear and cooperating means adapted to feed said device, planetary gears driving said bevel gear, another gear coöperating with said planetary gears in the driving of bevel gear, electric motors for driving said planetary gears and said last-mentioned gear respectively and connections whereby the speed of said motors is varied automatically upon increases in the resistance offered the work device.

17. The combination of a work device, means for feeding the work device toward and from its work, two driving means for said feeding means having a differential action to affect the feeding of the work device and means whereby said differential action is affected by the resistance offered the work device.

18. The combination of a work device, means for feeding the work device, two driving means for operating said feeding means, the differential action of which acts to vary the speed of the feeding means, one of said driving means comprising an electric motor, an electric motor for operating the work device and means whereby the field of said first-mentioned motor is varied to vary its speed and the speed of the feeding means responsive to variations in current taken by the motor operating the work device.

19. The combination of a work device, means for feeding the work device toward and from its work, two driving means for said feeding means having a differential action adapted to drive the feeding means in either direction while themselves acting both in the same direction and means whereby said differential action is affected by the resistance offered the work device to retard and reverse the feeding of the work device in accordance with the resistance offered the work device.

20. The combination of a work device, means for feeding the work device, two electric motors for driving the feeding means and having a differential action adapted to drive the feeding means in either direction while themselves acting both in the same direction and means whereby said differential action is affected by the resistance offered the work device, to retard and reverse the feeding of the work device in accordance with the resistance offered the work device.

21. The combination of a work device, means for feeding the work device, two driving means for said feeding means, and means whereby the speed of one driving means may be varied to retard the speed of the feeding means and reverse the speed thereof, affected by the resistance offered the work device.

22. The combination of a work device, means for feeding the work device, two motors operating said feeding means, and means whereby the speed of one motor may be varied to retard the speed of the feeding means and reverse the speed thereof affected by the resistance offered the work device.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

LOUIS H. THULLEN.

Witnesses:
E. E. HAINES,
G. A. BERKHAN.