W. A. GRÖNDAHL.

MACHINE FOR FELLING TREES.

APPLICATION FILED MAR. 23, 1910.

1,002,678.

Patented Sept. 5, 1911.

2 SHEETS—SHEET 1.

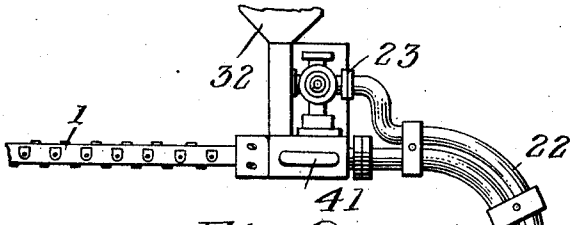


Fig. 1.

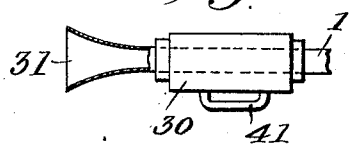
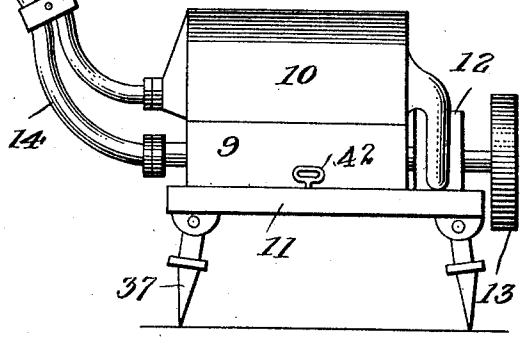


Fig. 2.



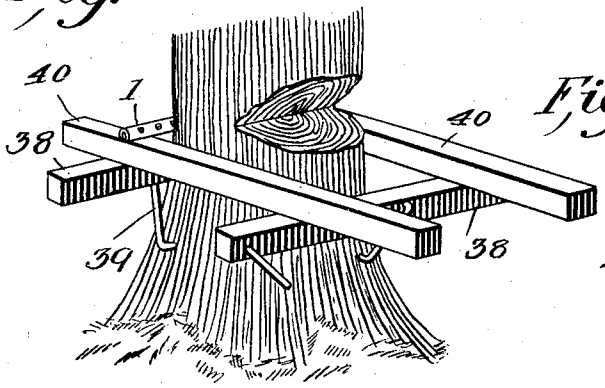


Fig. 4.

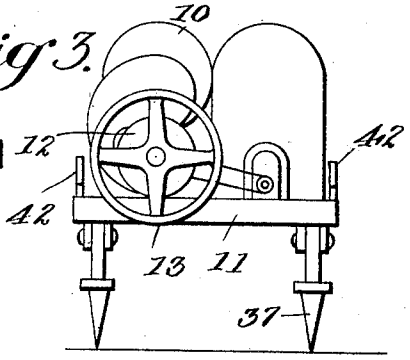


Fig. 3.

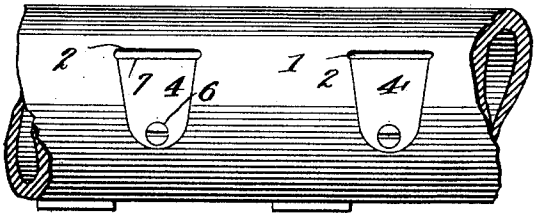


Fig. 5.

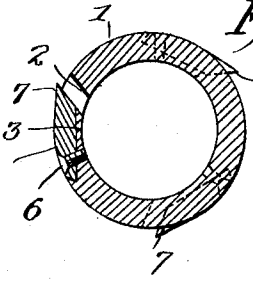


Fig. 6.

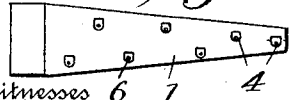


Fig. 11.

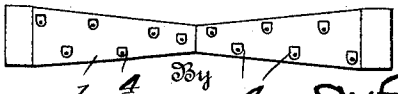


Fig. 12.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 7.

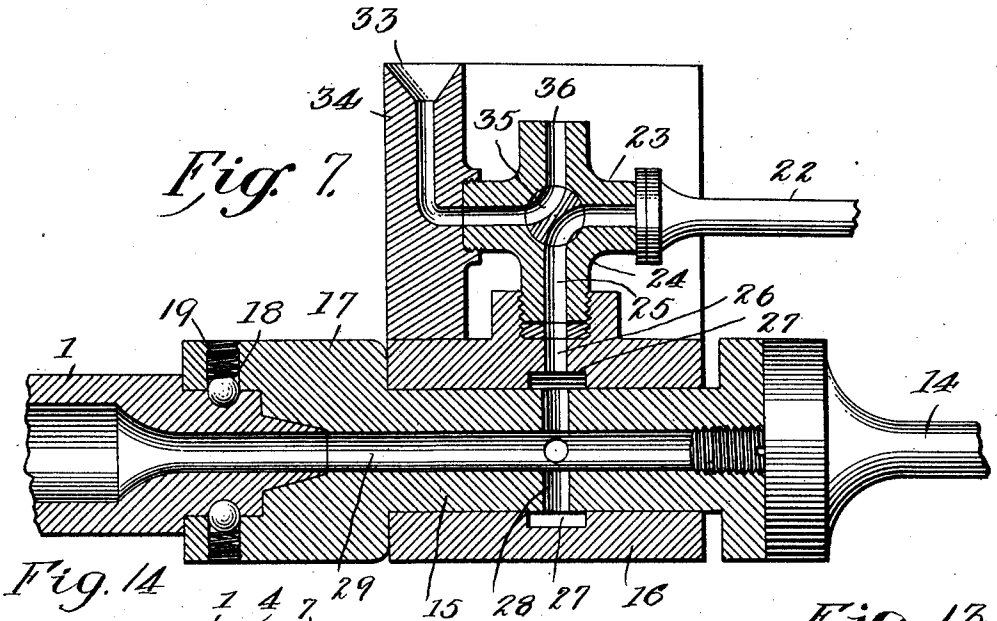


Fig. 14.

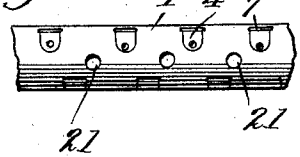


Fig. 13.

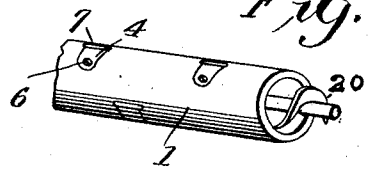


Fig. 8.

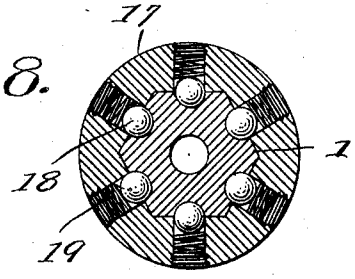


Fig. 9.

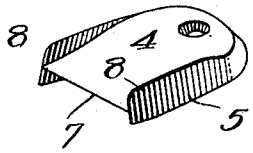


Fig. 10.

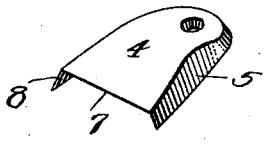
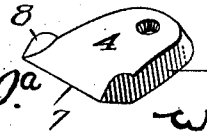


Fig. 10a.



Witnesses

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WILHELM A. GRÖNDAHL, OF PORTLAND, OREGON, ASSIGNOR OF ONE-THIRD TO JOSEPH W. HILL AND ONE-THIRD TO EDWARD W. BARNES, BOTH OF PORTLAND, OREGON.

MACHINE FOR FELLING TREES.

1,002,678. Specification of Letters Patent. **Patented Sept. 5, 1911.**

Application filed March 23, 1910. Serial No. 551,179.

To all whom it may concern:

Be it known that I, WILHELM A. GRÖNDAHL, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented new and useful Improvements in Machines for Felling Trees, of which the following is a specification.

This invention relates to mechanism for felling trees, and its object is to provide a lumbering concern with an apparatus which is portable and efficient, can be readily handled by two or three men, is capable of being transported into thick woods and through underbrush, can be quickly set up, will operate not only to fell the tree but also to cut it up into saw logs, and will do the work at a very rapid rate.

To this end the invention comprises a small, light motor, preferably a gasolene engine of the motor-cycle type, provided with handles so that it can be picked up and carried by one or two men; a tubular cutter bar rotatable at high speed by said motor, a flexible driving connection between said cutter bar and motor, means for removing the chips, preferably by forcing a blast of air through the interior of said tubular cutter bar, means for quickly disengaging said bar from the driving connection, and means for feeding gasolene or other solvent into said bar to dissolve the pitch in case it clogs up.

In the accompanying drawings, Figure 1 is a side elevation of my improved tree felling apparatus. Fig. 2 shows the end of the tubular cutter bar. Fig. 3 is an end elevation of the engine. Fig. 4 shows the framework for supporting the cutter bar when at work. Fig. 5 is an elevation of a portion of the cutter bar on a larger scale. Fig. 6 is a cross section of said bar. Fig. 7 is a section of the driving chuck for said bar. Fig. 8 is a cross section of the same. Figs. 9, 10 and 10^a are perspective views of removable cutters for use on the cutter bar. Figs. 11 and 12 show modified shapes of cutter bars. Fig. 13 shows a worm for removing the chips, and Fig. 14 shows a cutter bar with air-escape ports.

The most important element of my invention is the cutter bar 1, which is a tubular shaft of suitable length, depending upon the size of the trees in which it is expected to operate. In the woods of the northwest coast country, long bars will of course be necessary, as many trees are found there which will run from eight to fifteen feet in diameter. The cutter bar is provided with a plurality of openings 2 and adjacent to each opening is a recess 3 in which is seated a removable cutter 4, preferably secured by making its side edges 5 beveled to engage with undercuts along the sides of the recess. The cutter or tooth is also preferably slightly tapering from its cutting edge backwardly, so as to wedge in its recess. As a matter of precaution, a screw 6 may be passed through the rear end of each tooth and into a tapped hole in the body of the bar. The cutting edge 7 of each tooth overlaps the opening 2, so that all or nearly all the chips or cuttings made by the tooth will pass through said opening into the bar. The teeth are grouped around the bar in a helical arrangement, and are preferably so spaced apart that the edge of the kerf cut by one will just register with the edge of that cut by the next, and in this way a practically continuous cut will be made along the entire length of the bar. The cutting edge of the tooth of course projects slightly above the surface of the bar, preferably about the fiftieth of an inch. The tooth may have a simple beveled edge like a plane bit, as shown in Figs. 5 and 6, or it may have pilot cutters 8 on each side of the cutting edge, and these may extend both above and below the main cutting edge, as in Fig. 9 or below it only, as in Fig. 10, or above it only, as in Fig. 10^a.

Other forms than those shown in the drawings may be used, the illustrations being merely suggestive and not intended to limit my invention to their use alone; the essential feature being that the removable teeth or cutters shall be located adjacent to openings through the bar so that their cuttings will pass into the interior of the bar. I prefer to use a cylindrical bar, but for some

purposes a tapering bar may be better, as shown in Fig. 11, or even a bar like that shown in Fig. 12, composed of two tapering portions placed with their small ends joining. The object of these two constructions is to enable the bar to clear itself of chips by the tendency of the chips to fly outward under centrifugal force and to work along the bar toward the larger end or ends thereof, where they will be discharged.

For rotating the cutter bar, I provide a light portable motor, such as a gasolene engine of the motor-cycle type. I have indicated a four-cylinder engine of this kind at 9 in Figs. 1 and 3. The cylinders are inclosed in a casing 10; and mounted on the base-plate 11 of the engine is a blower 12 delivering air to the casing to cool the cylinders. I prefer to use a rotary blower, and to mount its runner directly on the shaft of the engine, which is prolonged for this purpose, and carries on its outer end the usual fly-wheel 13 to give steadiness to the engine and enable it to be readily turned over in starting. The other end of the engine shaft is coupled to one end of the cutter bar 1, by means of some kind of a flexible connection, preferably a so-called flexible shaft 14, composed of coils of wire inclosed in a casing. For connecting the end of this flexible shaft to the bar, I prefer to employ some kind of a chuck, such as the one shown in section in Fig. 7. This chuck has a journal 15 rotating in a bearing 16, and a head 17 having a polygonal socket into which one end of the cutter bar can be inserted. This end of the bar is also polygonal, as shown in Fig. 8, and the chuck is provided with retaining devices for holding the bar in place. I prefer to make these retainers yielding, so that the bar can be pulled out of the chuck by the exercise of considerable force. In the drawing, I have shown balls 18 housed in pockets in the head 17 and urged into recesses in the cutter bar for a portion of their diameter, so that they engage with both the head and the bar. Behind each ball is a spring 19, which holds the ball in engagement with the bar under normal conditions, but will yield and permit the bar to be pulled out of the chuck when necessary. Other equivalent retainers may be substituted for these spring-pressed balls, if desired.

As has been stated, the bar may be made of such shape as to automatically clear itself of chips, but I prefer to provide some mechanism for accomplishing this result. Thus, I may use a worm 20 as shown in Fig. 13, said worm being preferably stationary inside of the rotating tubular bar, to carry the chips to the discharge end of the bar. The worm is attached at one end to the separate portable bearing which carries the free end of the rotary cutter bar, so that said worm will maintain a practically stationary position, the bar revolving around it. This relative movement of the worm and bar results in carrying the cuttings out to the end of the bar where they fall to the ground. I much prefer, however, to make use of a blast of air to carry out the chips, and this blast may be either confined wholly to the interior of the bar, or may be allowed to escape therefrom through suitable ports 21, so that it will blow away from the bar those chips which have not passed into the same. For this purpose I prefer to utilize the air forced by the blower through the casing of the engine, so that this air performs the double duty of cooling the engine and cleaning out the cutter bar. Various means may be used to convey this air into the cutter bar, but I prefer to lead it through a flexible hose 22 running from the end of the casing 10 to a nipple 23 on a valve casing 24 screwed into an opening in the top of the bearing 16. The passage 25 of this valve casing communicates with a passage 26 in the bearing which terminates in a circumferential groove 27 surrounding the journal 15. The entire chuck is tubular, and it contains also the radial ports 28 connecting the interior bore 29 with the groove 27. The central bore 29 in turn communicates with the hollow interior of the cutter bar, so that the air entering the valve casing at 23 passes freely at all times to the rotating cutter bar, and blows out of its other end, or out through the ports 21. A bearing 30 is provided for the remote end of said cutter bar, and may be provided with a spout 31 for delivering the stream of chips and cuttings which is forced out by the blast of air.

The warmth of the air, derived from the hot cylinders of the engine, tends to soften any pitch which may enter the cutter bar with the chips, but in case the pitch becomes troublesome and tends to clog up the bar, it can be dissolved by introducing a small quantity of gasolene or other solvent. This may be carried in a can 32, which can be inverted with its mouth tightly fitting into a socket 33 in the upper end of a pipe 34 connected with the valve casing 24 and controlled by the same valve 35 regulating the supply of air. The valve is a four-way valve and in the position in which it is shown in Fig. 7 it shuts off the gasolene pipe and admits the air to the cutter. By giving it a quarter turn, the air will be directed up through the escape passage 36, and the gasolene pipe be put in communication with the cutter bar. The air is thus prevented from blowing the gasolene back into the can while it is being fed to the cutter bar, but upon being again admitted to the bar it will force the gasolene to all parts of the

cutting apparatus, so that any pitch will be quickly dissolved.

In using the machine in the woods, the engine is set up near the tree which is to be felled; the base plate being preferably provided with short legs 37, hinged or otherwise adjustably connected to the plate so that the engine can be rendered level whatever the nature of the ground on which it stands. If desired these legs may be shorter than shown, or may be omitted altogether. A framework is built around the tree, composed of a couple of logs or timbers 38 fastened to the trunk of the tree by dogs 39 or otherwise, and on opposite sides of the tree. On these, on opposite sides, are spiked two parallel timbers 40, substantially horizontal, and at the height at which the tree is to be cut. The timbers 40 are spaced apart the distance between the two bearings 16 and 30, which are rested on their respective timbers, and by means of suitable handles 41 are then forced along said timbers, carrying the rotating cutter bar laterally against and into the tree trunk. A horizontal cut is first made, which is then intersected by a diagonal cut made from above downward, so that a wedge-shaped block is removed from the tree, leaving the under-cut, so-called, as shown in Fig. 4. The bar is then transferred to the other side of the tree, and forced laterally through it toward the undercut until the tree is ready to fall. When the proper moment arrives, the man operating the remote end of the cutter bar gives it a jerk which disengages it from the chuck, so that he can run out of danger with it, while the man operating the chuck end can grab the handle on the bearing 16, seize one of the handles 42 on the base plate of the engine, and with the assistance of another man on the other side of the engine carry it and the flexible shaft and air hose off to a safe distance from the falling tree. Once down, the tree can be cut up into logs by causing the rotating cutter bar to pass down through it at the proper points. The same bar can be used to trim off branches.

My improved tree felling apparatus possesses a distinct advantage over the customary method of sawing off the tree, because it can be used low down on the trunk, where the tree is of considerable diameter, owing to the spread of the roots. Ordinarily, the lumberman cuts the tree at some distance up from the ground in order to save labor in going through the spreading butt, and this causes a great waste of good lumber, as the stumps which are left are sometimes fifteen or twenty feet high. Moreover, in cutting at this height, the lumberman must work standing on a spring board, so that he is in more or less danger of falling; a contingency which my invention entirely obviates. I can also put my apparatus to good use in cutting up the tall stumps which have been left by the ordinary methods of lumbering, as it is possible to cut these off substantially level with the ground. The chuck feature enables a lumberman to carry two or three lengths of cutter bar, which can be substituted one for the other as occasion demands.

Having thus described my invention, what I claim is:

1. An organized instrumentality for felling trees, comprising a small internal combustion engine portable by one or two men, a flexible shaft driven by said engine, a portable bearing for the free end of said shaft, a cylindrical tubular bar detachably connected to the free end of said shaft and provided with openings, cutters secured to said bar adjacent to said openings, a portable bearing for the other end of said bar, said bearings being connected by said bar only, and means for removing the cuttings from the interior of said bar.

2. An organized instrumentality for felling trees, comprising a small internal combustion engine portable by one or two men, a flexible shaft driven by said engine, a portable bearing for the free end of said shaft, a cylindrical tubular bar detachably connected to the free end of said shaft and provided with openings, cutters secured to said bar adjacent to said openings, a portable bearing for the other end of said bar, said bearings being connected by said bar only, and means for removing the cuttings from the interior of said bar, comprising a rotary blower mounted on said engine, and a flexible hose connecting said blower with the interior of said bar.

3. An organized instrumentality for felling trees, comprising a small internal combustion engine portable by one or two men, a flexible shaft driven by said engine, a portable bearing for the free end of said shaft, a cylindrical tubular bar detachably connected to the free end of said shaft and provided with openings, cutters secured to said bar adjacent to said openings, a portable bearing for the other end of said bar, said bearings being connected by said bar only, means for removing the cuttings from the interior of said bar, comprising a rotary blower mounted on said engine, a casing surrounding the engine cylinders and connected with said blower, and a flexible hose connecting said casing with the interior of said bar.

4. An organized instrumentality for felling trees, comprising a small internal combustion engine portable by one or two men, a flexible shaft driven by said engine, a portable bearing for the free end of said shaft, a cylindrical tubular bar detachably

connected to the free end of said shaft and provided with openings, cutters secured to said bar adjacent to said openings, a portable bearing for the other end of said bar, said bearings being connected by said bar only, means for removing the cuttings from the interior of said bar, a reservoir of solvent, and means for shutting off the air and connecting said reservoir with the interior of said bar to permit the solvent to soften pitch and similar substances.

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

WILHELM A. GRÖNDAHL.

Witnesses:
G. W. STAPLETON,
HENRY BOEHMKE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."