Nov. 18, 1947. F. E. DULMAGE 2,431,294

MODIFIED BAR-STOCK CHUCKING LATHE WITH ROTARY CUTTERS

Filed Nov. 1, 1945 2 Sheets-Sheet 1

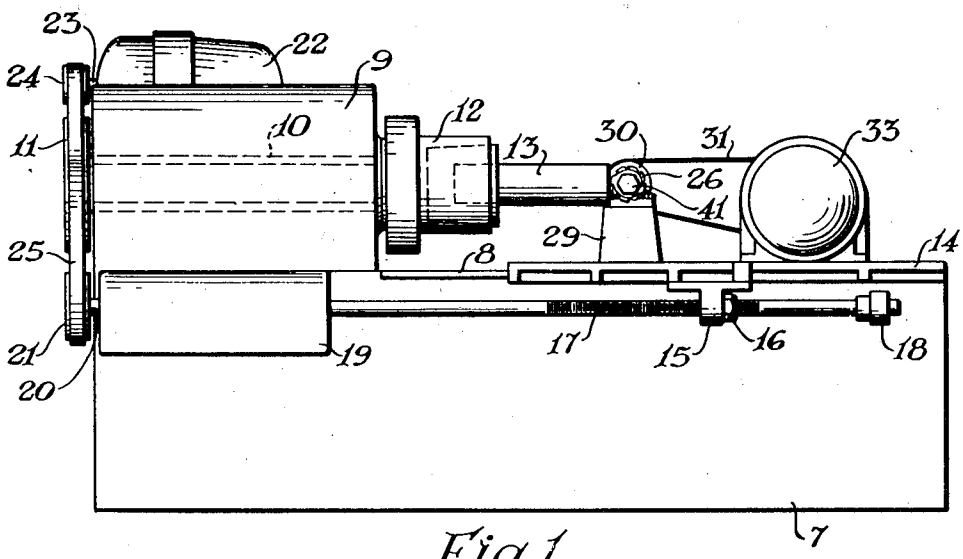


Fig. 1

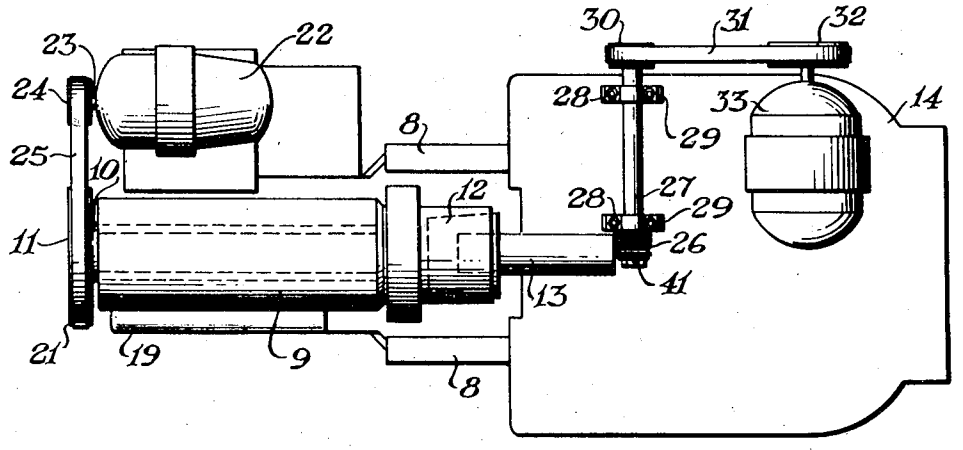


Fig. 2

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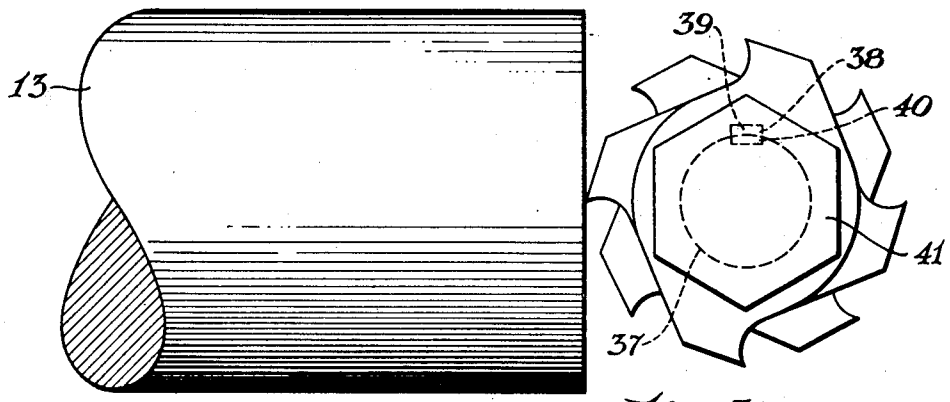


Fig. 3

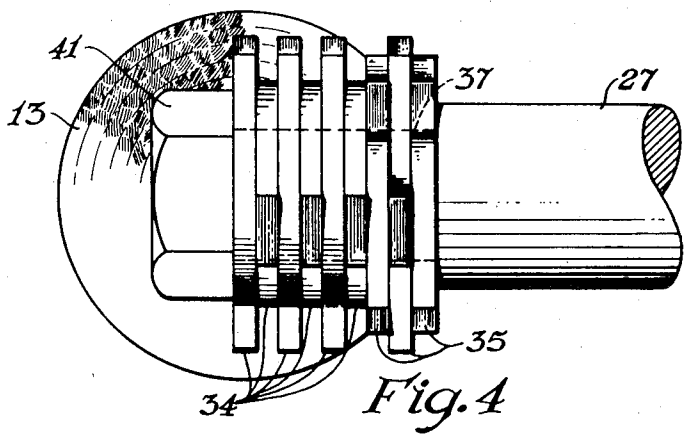


Fig. 4

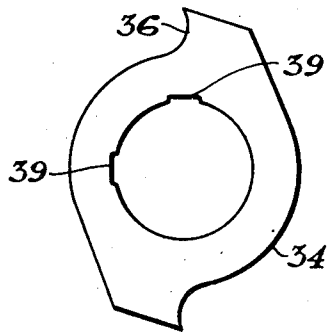


Fig. 5

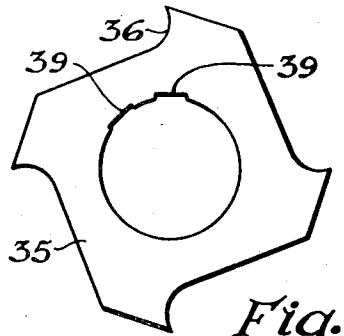


Fig. 6

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UNITED STATES PATENT OFFICE

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MODIFIED BAR-STOCK CHUCKING LATHE WITH ROTARY CUTTERS

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2 Claims. (Cl. 241—279)

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This invention relates to an improved machine for reducing a metal to chips.

In certain chemical processes in which one of the reactants is a metal, for example, in the preparation of Grignard reagents from metallic magnesium, it is desirable that the metal employed be finely divided, but not in powder form. In the past, it has been customary to secure the metal as scrap cuttings from machining operations, such as turnings, shavings, filings, and sawdust.

In the case of large-scale chemical operations, however, not only are these sources of metal unreliable, but the cuttings themselves have undesirable properties. They may, for example, contain a high proportion of fine metal dust, or of cutting oil residues, dirt, and other non-metallic materials. Again, they may be so curled or ill-assorted in size that they are not sufficiently free-flowing to be fed through conduits into the chemical reactor. In addition, with reactive metals such as magnesium, the cuttings may be coated heavily with oxide as a result of exposure to air while hot.

Because of these difficulties, it is the principal object of the present invention to provide a process and a machine serving as an improved source of finely-divided metal for use in chemical processes. Another object is to provide a method and machine for reducing a solid block of metal completely to clean, flat, unoxidized chips which are free-flowing and of uniform size. A further object is to provide a machine for making metal chips at a considerably higher rate than has heretofore been achieved.

In accordance with the invention, a block of the metal, preferably cylindrical, is rotated rapidly. At the same time, one or a gang of toothed cutters is also rotated rapidly and advanced against the end of the rotating block. The cutters engage the metal of the block and convert it rapidly to flat, clean chips without appreciable formation of fine powder and without heating the chips to a temperature sufficient to cause surface oxidation.

The invention may be explained in detail with reference to the accompanying drawing in which

Fig. 1 is a diagrammatic front elevation of a machine for converting cylindrical blocks of magnesium to chips;

Fig. 2 is a plan view of the machine of Fig. 1;

Fig. 3 is an enlarged fragmentary front elevation showing the relative positions of the cylindrical block and the assembled gang of cutters;

Fig. 4 is an end elevation of the view of Fig. 3; and

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Figs. 5 and 6 are views of individual cutter blades.

The machine illustrated is a modified bar-stock chucking lathe, and comprises a bed or frame 7, provided at one end with parallel horizontal ways 8 and at the other with a headstock 9. Journalled within the headstock and extending outwardly from both its ends is a hollow spindle 10 parallel to the ways. Fitted on the end of the spindle remote from the ways is a drive pulley 11 while on the other end is mounted a universal chuck 12. This latter serves to grip a cylindrical workblock 13 of the metal to be reduced to chips.

A horizontal carriage or table 14 is mounted slidably on the ways 8 and is provided at its front with a drive bracket 15 which supports a nut 16 engaging a lead screw 17. This latter is supported at one end in a bearing 18 and at the other enters a conventional change-gear box 19, from the other end of which projects a shaft 20 carrying the drive-pulley 21.

The power for rotating the chuck 12 and for moving the table 14 is supplied by a motor 22 having on its shaft 23 a pulley 24 engaging a drive-belt 25 which also passes over the spindle pulley 11 and the gear-box pulley 21.

Chipping of the workblock 13 is accomplished by a gang of cutters 26 fitted on a horizontal arbor 27 which is journalled in pillow-blocks 28 carried by mounts 29 attached rigidly to the table 14. The mounts 29 are adjusted so that the axis of the arbor 27 is coplanar with and normal to the axis of the spindle 10, i. e. with the axis of rotation of a workblock 13 secured in the chuck 12, as is shown particularly in Figs. 3 and 4. The arbor 27 terminates at one end in a pulley 30 which is driven by a belt 31 running over the corresponding pulley 32 of a motor 33 mounted on the table 14.

The width of the cutter gang is preferably made equal to or slightly greater than the radius of the workblock 13, and the cutters are mounted on the arbor in a position in eccentric alignment with that of the workblock (see Fig. 4). In this way, it is insured that every point on the workblock at each revolution is engaged by at least one of the cutting teeth.

The individual cutters 34 and 35 (Figs. 5 and 6) resemble dado cutters, and consist of annular disks each having two or more hardened metal-cutting teeth 36 on the periphery. Each cutter slips over a reduced diameter 37 at the end of the arbor 27 and is held from turning by a key 38 which fits into registering slots 39 and 40 on the cutter and arbor, respectively, and from moving

laterally by a capnut 41 screwed on the end of the arbor. Each cutter is provided with two or more of these key slots 39 so that it may be used at more than one angular position on the arbor. As shown, adjacent cutters are set at different angular positions so as to allow ample free space for the escape of chips. In the particular machine illustrated, the cutters 34 which are in alignment with the central portion of the workblock 13 have only two teeth while the cutters 35 aligned with the outer portion of the block have four teeth. This difference in the number of teeth compensates for the higher linear rotational speeds of the outside of the block, and assures that all chips have approximately the same size.

The speeds of rotation of the spindle 10 and the arbor 27, as well as the feed-rate of the table 14, may be altered as required by selecting drive pulleys of the appropriate size.

In operating the machine, the cutter gang 26 is first assembled and aligned as illustrated. A cylindrical block of the work is then clamped in the chuck, and the spindle 10 and the cutter arbor 27 are set in rotation. The gears in the change-box 19 are then engaged, causing the table 14 to advance toward the chuck. The rotating cutter gang 26 soon strikes and feeds into the free end of the rotating workblock, rapidly reducing it to chips.

The width of the chips is determined by the thickness of the cutter blades 34 and 35. The length of the chips is governed by the relative rates of rotation of the cutter gang and the workblock, and the thickness is controlled by the rate of advance of the table 14. Each of these variables may be adjusted, as already explained, to produce chips of any desired size. Preferably, however, the rate of rotation of the cutter gang should be at least several times the rate of rotation of the workblock, so that each cutter blade makes a considerable number of chips per revolution of the workblock.

In the typical case of making magnesium chips from a 4-inch diameter cylindrical magnesium billet, nine cutters each 0.25 inch thick and 3.5 inches diameter (tooth to tooth) are assembled into the gang, the inner six cutters having two teeth each and the others four. The work block is rotated at 300 R. P. M. and the cutter arbor at 2000 R. P. M., the table being advanced 7 inches per minute. Under these conditions, chips approximately 0.5 x 0.25 x 0.025 inch are obtained which have little curl and are practically free of oxide coating. Rates of chip production of several pounds per minute are easily achieved.

It will be appreciated that the machine described produces clean, free-flowing chips which are nearly uniform in size and are practically free of dust. In addition, since the entire workblock is cut off progressively and at a high rate, each uncut portion remains comparatively cool almost up to its instant of cutting. The chips thus are far cooler than those produced by other chipping methods, and hence do not become appreciably oxidized in the air.

It is to be understood that the foregoing description is illustrative rather than limitative, and that the invention is co-extensive in scope with the following claims.

What is claimed is:

1. In a machine for reducing a metal to chips, in combination with a power-driven spindle having mounted thereon a chuck adapted to hold a cylindrical workblock therein: a power-driven arbor mounted coplanar with and normal to the axis of the spindle, a cutter gang of width approximately equal to the radius of a workblock secured on the arbor in a position in eccentric alignment with that of a workblock held in the chuck, such gang consisting of a series of adjacent peripherally-toothed cutters in which those cutters in alignment with the central portion of a workblock have fewer teeth than those in alignment with the outer portion, and means for advancing the arbor and cutters toward the chuck and against the end of a workblock therein.

2. In a machine for reducing a metal to chips, in combination with a bed having horizontal ways, a headstock having therein a power-rotated spindle parallel to the ways, a chuck mounted on the spindle and adapted to hold a cylindrical workblock axially therein, and a carriage slidable on the ways and provided with power feed for moving it toward the chuck: a power-rotated arbor mounted on the carriage coplanar with and normal to the axis of the spindle, and a cutter gang of width approximately equal to the radius of a workblock secured on the arbor in a position in eccentric alignment with that of a workblock held in the chuck, such gang consisting of a series of adjacent annular peripherally-toothed cutters of equal cutting diameter in which no cutter has more than four teeth and in which those cutters in alignment with the central portion of a workblock have fewer teeth than those in alignment with the outer portion.

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