May 3, 1938. H. LINDNER 2,116,031

MACHINE FOR GRINDING SCREW THREADS

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Fig.1

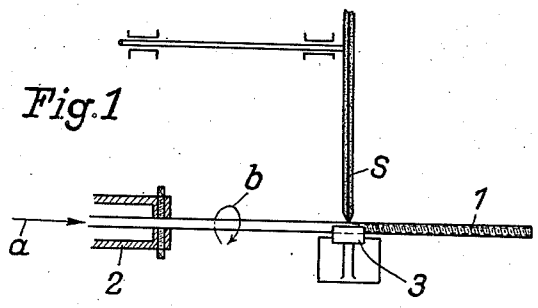

Fig.2

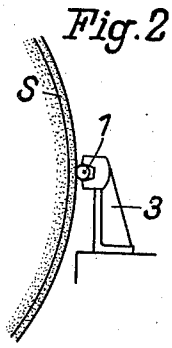

Fig.3

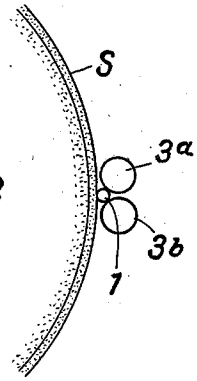

Fig.4

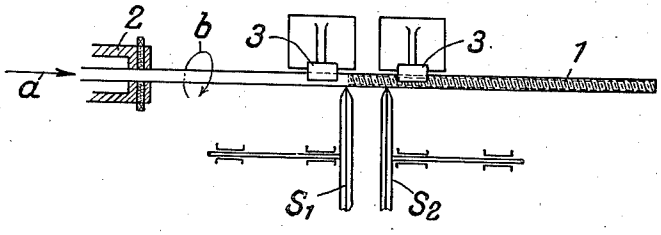

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Fig. 6

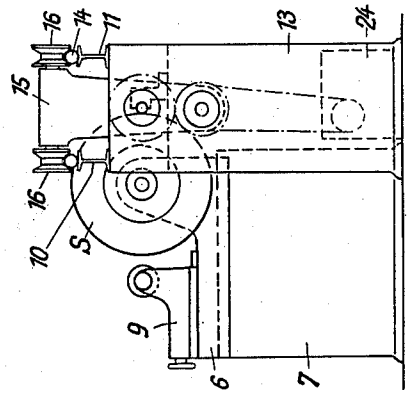
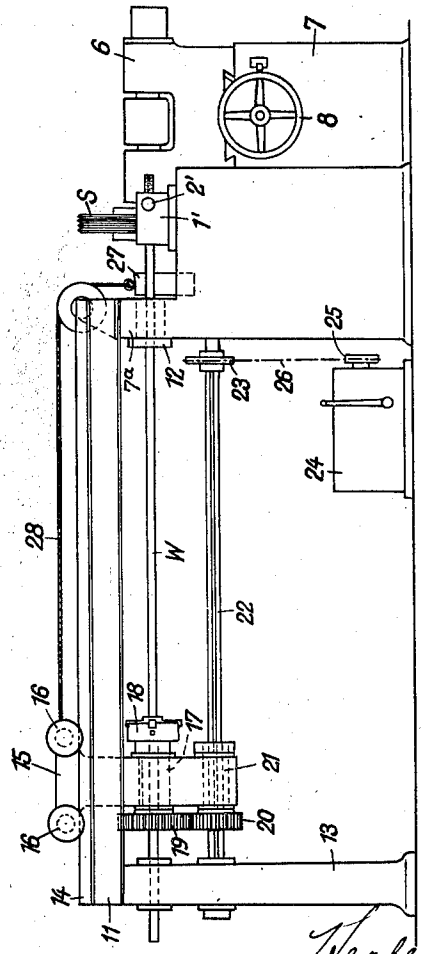


Fig. 5



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MACHINE FOR GRINDING SCREW THREADS

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Fig. 7

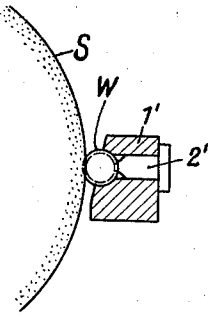


Fig. 8

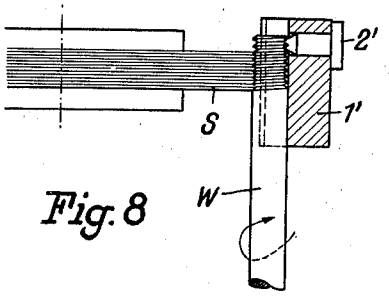


Fig. 9

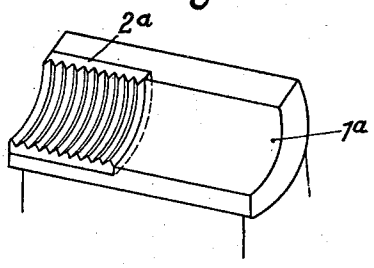


Fig. 10

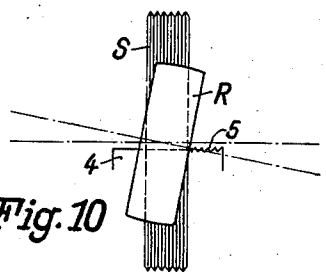


Fig. 11

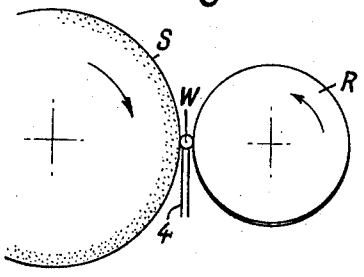
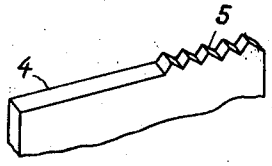


Fig. 12



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UNITED STATES PATENT OFFICE

2,116,031

MACHINE FOR GRINDING SCREW THREADS

Herbert Lindner, Berlin-Wittenau, Germany

Application December 4, 1935, Serial No. 52,927
In Germany December 21, 1934

2 Claims. (Cl. 51—103)

This invention relates to machines for grinding screw threads and has for its object to provide certain improvements in machines of this character.

In thread grinding machines as at present constructed the work piece to be ground is generally arranged to be supported in suitable headstock and tailstock centers and rotated by a driving member, the work piece being moved past a profiled grinding wheel having a fixed position with a feed proportional to the speed of rotation, this feed being effected by a lead screw or the like. In other thread grinding machines, the working feed is imparted to the grinding wheel, the work piece merely rotating. If the work piece is of relatively great length, it is generally supported at one end by a center and driving member and is further supported by one or more collars, which being carried on the grinding wheel slide participate in the feed movement. The work piece is thus continuously subjected, under the pressure of the grinding wheel, to deflections which are constantly varying since the distance between the point of engagement of the grinding wheel and the point of support is constantly changing. The same effect is produced if the grinding wheel is fed past the rotating work piece supported by half collars. These deflections, although generally relatively small, are still sufficient to affect unfavorably the high accuracy required in grinding screw threads. The main disadvantage, however, of existing types of thread grinding machines is that owing to the limited maximum stroke of the tool or work slide, only work pieces of limited screw-threaded length can be ground, this limit being approximately one meter.

The improved thread grinding machine of the invention differs from existing machines in that and according to the principal feature of the invention the work piece previously worked into a sufficiently exact cylindrical form, and the grinding wheel are arranged to be given the relative feed movement necessary for producing the screw thread, the work piece being supported by a guide which is essentially arranged substantially opposite to the grinding wheel and remains in this position during the grinding operation.

A thread grinding machine so constructed eliminates the disadvantages above indicated and enables screw threads of great length to be formed, more particularly on work pieces of small diameter. Preferably successive section grinding of the thread is adopted and arrangements are provided for effecting automatically the feed and other movements of the working parts of the machine. The centering of the work piece is effected either solely by the guide located opposite to the grinding wheel, or jointly by this guide and the pressure of the grinding wheel. The improved machine is of relatively small, compact and inexpensive construction.

Grinding wheels of relatively large diameter may be utilized which naturally have a larger profiled edge than those of small diameter, and it is advisable to provide a number of grinding wheels operating on successive portions of the thread, each wheel being adjustable independently as regards its inclination and level since if both or all the grinding wheels were mounted on a common shaft, the end wheels of the series, when the inclination of the shaft is adjusted to correspond to the pitch angle of the thread, would not engage at the center of the work piece but below or above it. Preferably the several grinding wheels are of different fineness of grain and/or hardness. By utilizing a number of grinding wheels in this manner, the work to be carried out is favorably distributed since the leading grinding wheel effects the preliminary grinding of the thread and the last wheel effects the final or finishing grinding.

According to a further feature of the invention the work piece is provided with an initial or starting thread and the guide member is so formed as to engage with this thread so as to constitute a lead or feed member which automatically guides the work piece past the grinding wheel with an axial feed corresponding to the pitch of the thread.

The work piece, having formed thereon one or more starting screw threads by the operation of the same or another thread grinding machine, and supported and centered by the guide arranged opposite to the grinding wheel, itself effects its own feed movement since it is supported and axially displaced during rotation by the guide.

The rotation of the work piece can, for instance, be effected by a driven control disk or roller arranged opposite to the grinding wheel, as is usual in centerless circular grinding. Furthermore, during the rotation of the work piece, the latter can be given an axial feed corresponding to the thread pitch by a corresponding inclination of the axis of the control disk or roller, the exact feed being however determined by the lead member engaging in the screw thread on the work piece.

This feature of the invention enables the relatively expensive lead screws and bearings hither-

to necessary, to be eliminated; or if these are provided for forming the initial or starting screw thread, they are relatively short and thus less costly, their working life being moreover considerably longer, since they are only temporarily in use.

Waste of time such as occurs in multiple thread grinding owing to the return movements necessitated between the grinding periods is eliminated, since comparatively long threads can be ground in a single passage. In general the machine is especially adapted for grinding threads on thin rods of great length.

The invention is illustrated by way of example in the accompanying drawings of which Figures 1 and 2 are diagrammatic views in plan and side elevation respectively of an arrangement embodying the essential principle of the invention. Figure 3 is a view similar to Figure 2 but illustrating a modification and Figure 4 is a plan view of an arrangement comprising two grinding wheels.

Figures 5 and 6 are views in front and side elevation respectively of a construction of thread grinding machine embodying the invention, Figures 7 and 8 being views in sectional side elevation and plan respectively of a portion of the machine of Figures 5 and 6. Figure 9 is a perspective view of a modified construction of the element shown in Figures 7 and 8. Figures 10 and 11 are views in front and side elevation respectively of a further modification embodying the invention and Figure 12 is a perspective view on an enlarged scale of an element shown in Figures 10 and 11.

Referring now first to Figures 1 and 2 of the drawings it will be seen that the work piece 1 in the form of a long cylindrical rod is arranged to be resiliently supported at its left hand end in a hollow lead screw member 2 by means of which the work piece 1 is rotated as indicated by the arrow *b* and fed forward past a grinding wheel S as indicated by the arrow *a*. A forked or crescent shaped guide member 3 is arranged opposite to the grinding wheel S and remains in this position during the grinding operation so that the work piece is positively gripped between the grinding wheel and the guide member at the grinding point.

The guide member 3 need not however be arranged exactly opposite to the grinding wheel S but may be located slightly to one side thereof if desired, it being however essential that the guide member should be substantially opposite to the grinding wheel so as to avoid bending the work piece 1 and should retain this position during the grinding operation.

The guide member may alternatively be constituted by two or more rollers as indicated at 3^a, 3^b in Figure 3.

In multiple thread grinding, that is to say, grinding the thread in successive sections of its length, which is usual for very long work pieces, the work piece is preferably arranged to be secured to the feed element by an automatic gripping device which may be electrically operated. The inward and outward movement of the grinding wheel at the beginning and end of each stage or section of the multiple grinding as well as the periodical stopping of the rotation of the work piece and the return movement of the feed element may also be arranged to be automatically and preferably electrically effected in order to ensure the work piece retaining its position during the intervals between successive gripping operations, a setting key or its equivalent may be provided at the guide member or another suitable point.

As shown in Figure 4, two grinding wheels S_1 and S_2 may be employed of which the wheel S_1 effects the preliminary or rough cutting of the thread and the wheel S_2 the final or finishing cut so as to distribute the work of cutting between the two grinding wheels. A separate guide member 3 is provided for each grinding wheel, the wheels being mounted on separate shafts which are arranged to be independently adjustable both as regards inclination and level. The two grinding wheels may be arranged to act upon opposite sides of the work piece, if desired, or three grinding wheels arranged 120° apart may be similarly utilized.

Referring now to Figures 5 and 6, in the thread grinding machine therein illustrated, a multi-ribbed grinding wheel S is employed, the spindle of which is mounted in the usual manner on a support 6 which is adjustable relative to the frame 7 of the machine by a hand wheel 8.

The rear portion of the support 6 carries a wheel dressing device 9, while on the front portion of the machine table a guide member 1' is provided opposite to the grinding wheel S for effecting the support and centering of the work piece. The guide member as shown in Figures 7 and 8 may be of semi-cylindrical form provided with a lead element directly mounted in the guide member 1'. As shown in Figure 9 the lead element 2*a* may be constituted by a sectional portion of a screw-threaded nut, which is secured to the guide member 1*a*. The lead element 2*a* is preferably arranged to be interchangeable so that the same guide member 1*a* can be utilized for different types of threads, or the guide member 1*a* as a whole may be arranged to be interchangeable for the same purpose, the guide member or lead element being secured in position in any suitable manner as for example by means of pins or screws. The lead element 2' need not be directly carried by the guide member 1' but may be separate therefrom if desired.

A construction of the type illustrated is preferable, however, since the lead element 2' and the guide member 1' are closely adjacent to each other. The machine is especially adapted for grinding long thin rods of material of high strength, which can only be worked unsatisfactorily or not at all with cutting tools.

The screw thread can be produced over the whole length of the work piece or on sectional portions thereof. The support of the work piece is effected not only at the guide member 1' but also at an interchangeable guide box 12 located in the upper portion 7*a* of the machine table. The portion 7*a* carries the front ends of the rolled channel beams 10, 11, the rear ends of which are carried by a supporting frame 13. The beams 10, 11 are provided with rods 14 of circular cross-section which serve as guides for a slide 15, the latter being mounted on rollers 16 resting on the rods 14 so as to reduce friction. Rotatably mounted in the slide 15 is a hollow spindle 17 through which the work piece passes and carrying at one end a bushing 18 for the work piece and at its other end a gear wheel 19 intermeshing with a gear wheel 20. The gear wheel 20 is mounted on a hollow spindle 21 also carried by the slide 15 parallel to the hollow spindle 17. Traversing the hollow spindle 21 is a key shaft 22 connected for rotation with the gear wheel 20. The key shaft 22 is rotated by means of a chain

wheel 23 driven from the main drive of the machine or independently thereof. In the machine illustrated an independent driving motor is provided, which is located together with a change gear in the casing 24, and operated through a chain 26 which drives the chain wheel 23. A weight 27 is provided connected by a cord 28 to the slide 15 so that when the work piece provided with the initial thread is set in rotation in the manner specified, the slide 15 under the action of the weight tends to shift the work piece along past the grinding wheel S. Since the thread initially formed engages with the lead element 2', the feed is determined by the thread of the work piece itself, and is effected to the exact requirement for the pitch of the thread. It will be understood that the rotary speed of the work piece is so determined that the grinding wheel can easily deal with the material to be cut away to produce the thread.

The machine illustrated is not arranged to produce the initial or preliminary thread which must be formed on another thread grinding machine. Alternatively the machine may itself be provided with a feed effecting mechanism as for example a lead screw casing, a short lead screw spindle or a feed cam which may be arranged in the portion 7a of the machine table 7, for instance. This mechanism is put out of action after the initial thread has been formed and the cutting of the thread is then effected in the manner specified. The direction of rotation of the work piece as well as the arrangement of the lead element 2' depends on whether a right- or left-handed thread is to be produced.

The machine can also be provided with a control roller, as is usual in centerless circular grinding (Figures 10 and 11). The guiding and centering of the work piece W is then mutually effected by the grinding wheel S, the control roller R and a guide member 4. The axially inclined position of the control roller R is so determined that the axial feed given to the work piece in addition to the rotation is suited to the pitch of the thread to be produced, the exact feed being however further determined by the guide member 5. For this purpose the lead element 5 of the guide member 4 is formed integral with the guide member 4 as shown in Figure 12.

It will be understood that the grinding wheels employed may be of the single or multi-ribbed type and in these and other respects the invention is not limited to the particular constructional arrangements described and illustrated by way of example.

What is claimed is:

1. In a machine for grinding threads on cylindrical bodies, means for supporting a cylindrical body and positively rotating the same, a thread grinding wheel arranged to contact the supported body at one side thereof, means for centering said body with respect to said wheel, said centering means comprising a guide arranged substantially opposite to the grinding wheel, means to rotate the grinding wheel, means to cause the body to move past the grinding wheel in contact therewith, and means carried by said guide and engaging the formed thread of said body, said last means comprising means for regulating the feed of said body.

2. In a machine for grinding threads on cylindrical bodies, means for supporting a cylindrical body and positively rotating the same, a thread grinding wheel arranged to contact the supported body at one side thereof, means for centering said body with respect to said wheel, said centering means comprising a guide arranged substantially opposite to the grinding wheel, means to rotate the grinding wheel, means to cause the body to move past the grinding wheel in contact therewith, and threaded means carried by said guide and engaging the formed thread of said body, said last means comprising means for regulating the feed of said body.

HERBERT LINDNER.