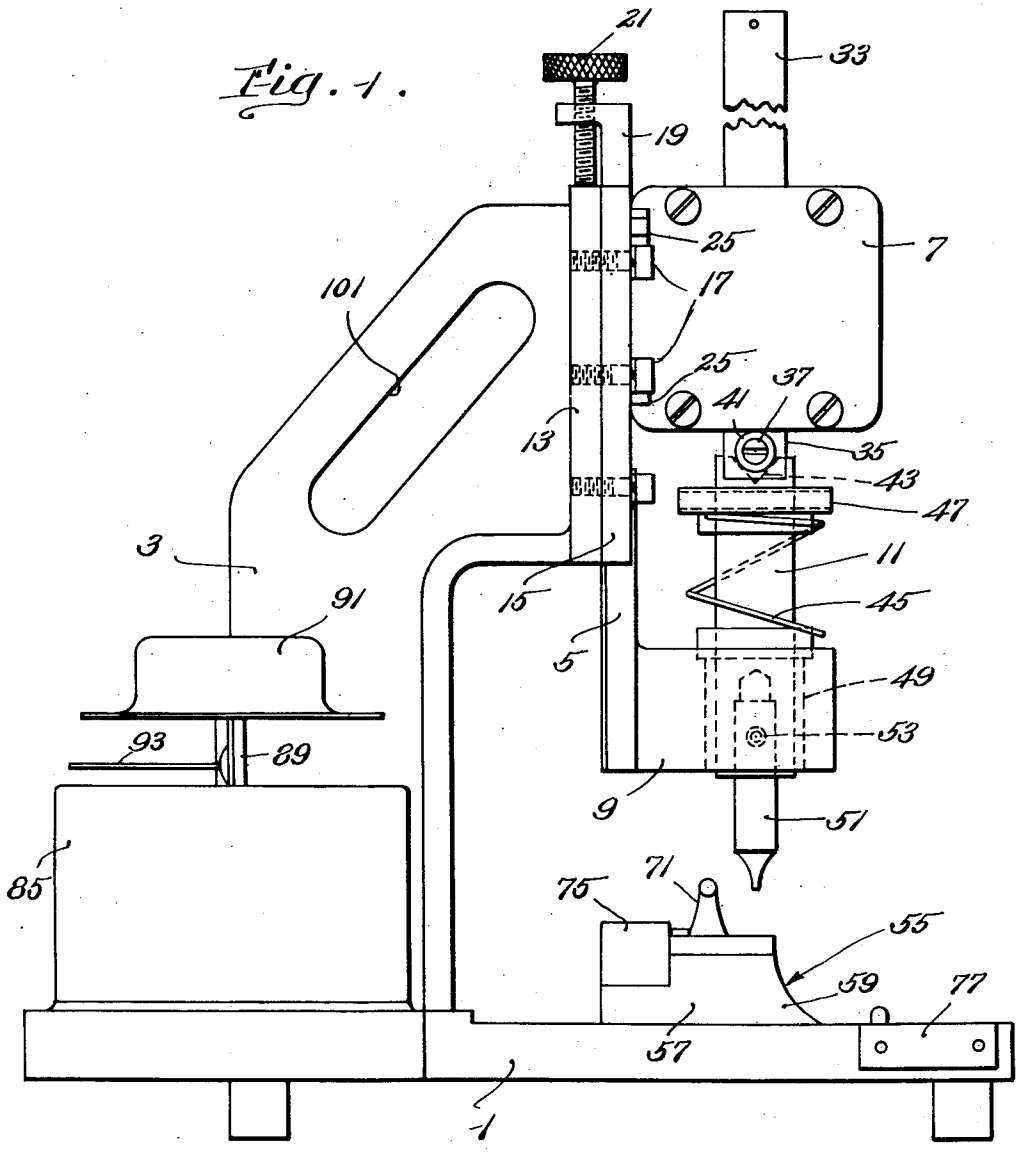
May 30, 1950 C. H. BENOIT 2,509,956

POWER PUNCH

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Fig. 1.



Inventor.
Conrad H. Benoit,
by Robert K. Randall,
Abby.

May 30, 1950 C. H. BENOIT 2,509,956

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Fig. 5.

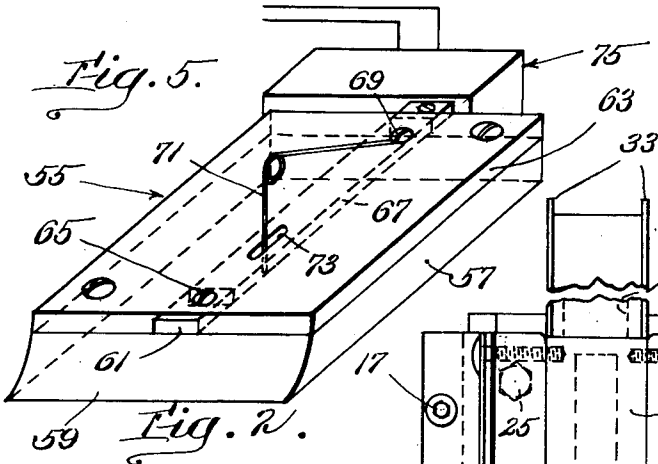
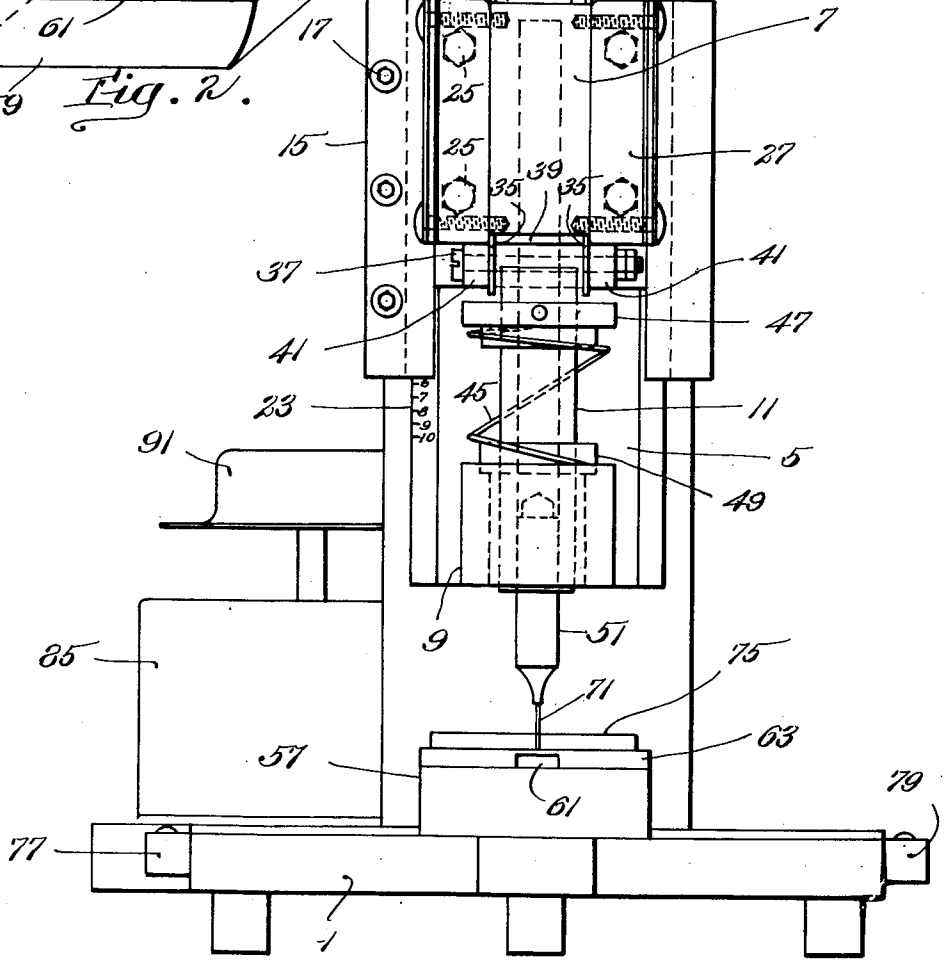


Fig. 2.



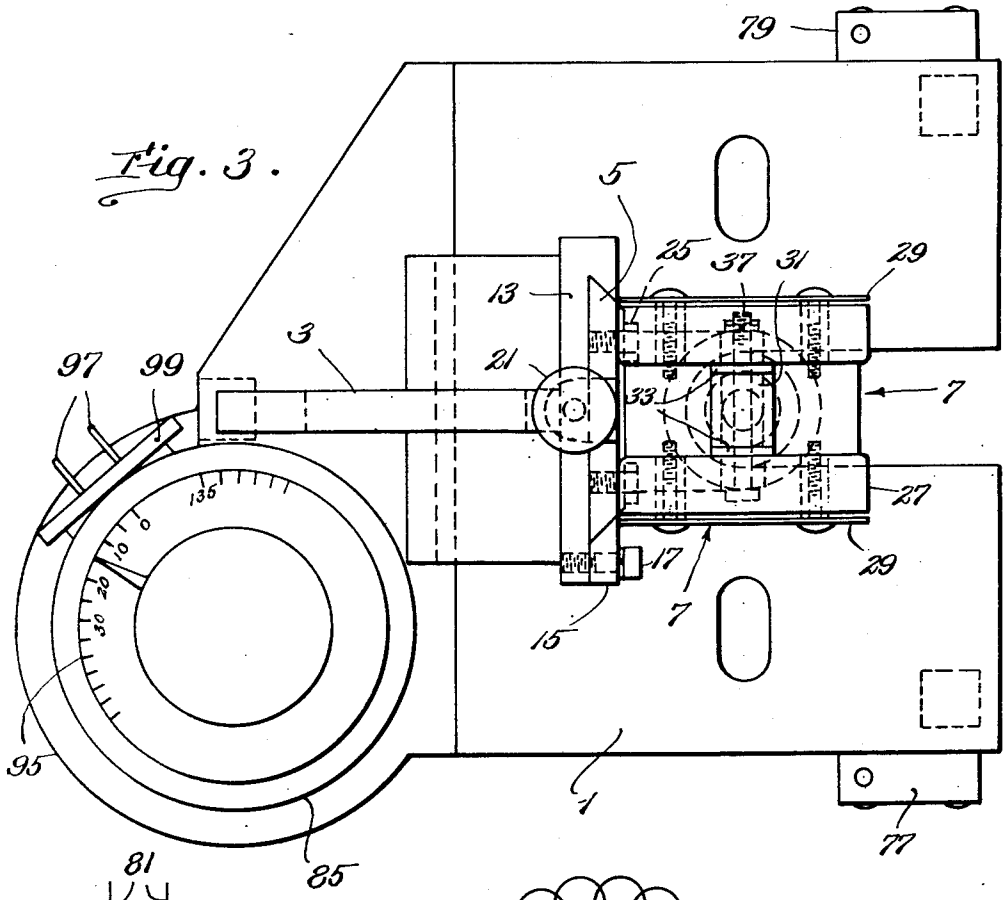
Inventor.
Conrad H. Benoit,
By Robert K. Randall.
Atty.

May 30, 1950 C. H. BENOIT 2,509,956

POWER PUNCH

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Fig. 3.



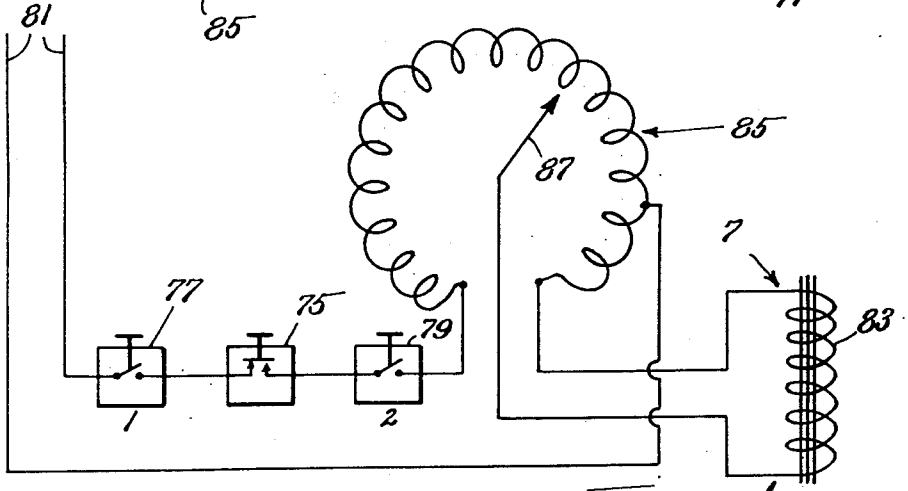


Fig. 4.

Inventor.
Conrad H. Benoit,
by Robert K. Randall,
atty.

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UNITED STATES PATENT OFFICE

2,509,956

POWER PUNCH

Conrad H. Benoit, Roslindale, Mass.

Application November 1, 1946, Serial No. 707,200

3 Claims. (Cl. 164—34)

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This invention has relation to punches and presses and in particular to devices of this sort especially adapted for performing relatively light and delicate operations of a punching or pressing character in the manufacture of jewelry, stamping of numerals and other characters on dials, rules, and other articles, the shearing, punching, and riveting of plastics, the setting of eyelets, grommets, electrical contact prongs, snap fasteners and the like, and other allied operations on small articles.

Hitherto the only machines commonly used for performing operations of these sorts have been operated by the muscular power of the user, and conventionally comprise various forms of the so-called kick press, with which unavoidable variations in the blow or pressure delivered by the working part of the machine occur through fatigue or inattention or lack of skill on the part of the operator. Too great or too little force applied in many delicate operations of the classes indicated is the cause of a serious amount of spoilage of the work in hand, with corresponding loss in economies in production. Thus, certain plastics are shattered during the above operations by a blow only moderately in excess of that required for performing such operations correctly; on the other hand, too light and cautious a blow results in incomplete punching of holes, or in the improper heading of rivets or incomplete setting of eyelets and snap fasteners, with consequent failure of the article in use or injury to it in the making. A common drawback in the kick presses operated by muscular power when employed for stamping numerals on dials, rules, and other articles, is that in the attempt to give the tool a definitely limited length of stroke a stop engaging the plunger or other working part is provided, and if the material being stamped varies in thickness, as it does in wooden rules, this variation results alternatively in a miss because the tool is stopped before traveling far enough to engage the work, or else in possible destruction of the work through penetration thereinto because not stopped in time.

An object of the present invention is to provide a device for performing these punching, pressing, slitting, riveting, shearing and related operations on light work, which shall be capable of performing the same operation repeatedly with unvarying force and length of stroke, but with this force, or the length of stroke, or both, being capable of variation to suit the needs of the job in hand, and with such variations designed to be of infinite degree, and in addition with the controls governing these variations calibrated so that the relative strength of the force and the length of the stroke can be predetermined and instantly varied from one known value to another known value. A further object of the invention is to provide a device for these uses which will be driven by electrical power, both to spare the operator from fatigue as well as to speed up the work, and also to achieve uniformity of force at any given setting. Still another object is to provide means for accurately locating the work with respect to the tool. An added object is to prevent accidental injury to the operator in the course of use of the device.

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To these ends, the invention comprises a suitably guided tool-carrying reciprocating plunger which is electro-magnetically impelled toward the work, by a controllable and variable degree of force, as by the armature of a solenoid to which the supply of actuating current is controlled in volume by means of a variable auto-transformer, variable resistance, or other suitable device whereby the power exerted upon the armature of the solenoid and on the plunger which is actuated by such armature is completely controlled and infinitely variable within the limits for which the device is built. To control and vary the range of the stroke of the plunger, the solenoid is mounted with infinite capacity for variation of its operatively fixed spaced relation toward and from the work-support. The auto-transformer or other current-controlling device is calibrated in a manner indicating the relative force of blow obtained at any setting thereof, and likewise a scale and index marking which are respectively located on the relatively fixed and movable parts of the solenoid mounting give a corresponding indication of the range of stroke obtained at any setting.

To locate the work accurately beneath the tool a work-holder is provided having circuit-closing means which prevents the flow of actuating current to the device and thus prevents the operation thereof unless the work is correctly positioned upon the work-holder in proper relation. In order to prevent accidental injury to the operator's hands by the movement of the tool, this work-holder is designed to hold the work securely without need for manual assistance, and also in addition to the circuit-closing means associated with the work-holder two additional circuit-closers are provided in series in the current-supply circuit, each of which must be operated simultaneously with the other by one of the operator's

hands, thus keeping them occupied at a safe distance away from the working parts.

Other objects of the present invention, and the manner of their attainment are as made plain hereinafter.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which

Fig. 1 is a side elevation, Fig. 2 a front elevation, Fig. 3 a plan view, Fig. 4 a circuit diagram, and Fig. 5 a perspective view of the work-locater.

On the base 1 of the tool is mounted a standard 3 adjustably supporting a slide 5, the latter carrying the solenoid 7 and having a frontwardly extending foot 9 at its lower end in which a plunger 11 constituting the tool-carrier is suitably guided for vertical reciprocation. The slide 5 is mounted in dove-tailed guideways in the front face of the vertical portion 13 of standard 3, one of the undercut guides comprising an applied piece 15 adjustable in its tension against slide 5 by screws 17. In an angular extension 19 of slide 5 is threaded a thumb screw 21 bearing against the top of portion 13 of the standard to permit micrometrically accurate raising and lowering of the slide 5 in order to vary the range of the stroke of the plunger 11, the adjusted position thus attained being retained by tightening the screws 17. A scale marked on the beveled edge of slide 5 as indicated at 23 enables any given range of stroke to be predetermined.

The solenoid 7 is mounted on slide 5 by means of screws 25 driven into the slide through the outturned flanges of the frames 27 which hold the coil and the laminations of the core of the solenoid, so that its armature 31 stands and moves in axial alignment with the plunger 11, a cover 29 being applied to each of these frames. The armature 31, which is impelled downward into the core and within the coil when current is applied, is equipped with upward and downward extensions 33, 35, arranged in spaced and parallel relation, and a bolt 37 is put through holes in the bottom extensions 35, this bolt bearing a bushing 39 filling the space between the two extensions 35 and shorter bushings 41 outside the extensions 35 which latter take bearing against the under sides of frame 27 to stop the upward travel of the moving parts as they recoil after each working stroke.

The central bushing 39 transmits the power of the solenoid to plunger 11 when the device is actuated, through resting in a V-shaped notch 43 formed for its reception in the top end of plunger 11. This simple connection between the two parts avoids difficulty in aligning the solenoid armature with respect to plunger 11 in setting up the parts. The plunger 11 and the solenoid armature are restored to their normal elevated waiting position of Fig. 1 after each downward stroke, by means of an expanding coil spring 45 coiled around the plunger and confined between the foot 9 of the slide and the flange of a collar 47 fixed by a taper pin on the upper portion of plunger 11.

The plunger works through a replaceable bushing 49 fixed in foot 9 of the slide. The proper tool for the particular operation being performed, such as the punch 51 illustrated in the drawings, is received in a socket formed axially in the lower end of plunger 11, being retained therein by a set screw 53.

The work holder and locater 55 is operatively fixed in suitable manner on the base 1. For each job, the work-supporting parts of the locater are specifically shaped to fit the exact portion of the particular piece of work which will be operated on throughout the run for which this set-up of the machine is being effected, and so as to index the precise wanted spot on the work directly beneath the tool. In addition, the locater includes a movable actuator for a micro-switch, which actuator is by the act of inserting the work-piece in the locater displaced so that it closes the micro-switch, but only succeeds in doing so when the work-piece is properly fitted into the site shaped for its reception. Thus, for example, assuming that a hole is to be punched through a lug extending from the base of a molded plastic object to receive a mounting screw, a work locater as shown in Figs. 1, 2 and 5 is provided comprising a block 57 having a rearwardly and upwardly curved front face 59 aiding the operator in guiding the lug into the open end of a slot 61 formed in the under side of a plate 63 fastened on the top of block 57. The slot is made just wide enough to receive the lug on the work-piece with friction enough to retain the lug in place, and a hole 65 is formed through top plate 63 and into the slot to permit the end of the punch 51 to strike the inserted lug at the proper point therein, a suitable recess being formed in block 57 in line with such hole to permit escape of the punchings. In this same slot 61 is slidably mounted an actuator bar 67, which is slotted for retention by screw 69 while retaining capacity for slight endwise movement. A light spring 71 anchored at one end beneath the head of screw 69 has its other end extending down through a slot 73 in top plate 63 into a hole in actuator 67 thus holding the latter normally forward in slot 61; but when the lug of the work-piece has been thrust into the open end of slot 61 to the proper depth, the actuator is displaced endwise rearward to a sufficient extent such that its rear end engages the button (shown in Fig. 4) of a micro-switch 75 and thereby throws this switch into circuit-closing relation, thus preparing the tool for operation as soon as other conditions are fulfilled.

These conditions comprise the manual actuation by the operator of two additional push button switches 77 and 79 respectively located at the left-hand and at the right-hand ends of base 1 of the machine, these switches being located in series with the work-actuated micro-switch 75 so that all three must be simultaneously closed, the manual switches being located so far apart that both of the operator's hands are required for their actuation and both hands are thus occupied at points well away from danger of injury by the tool 51 in making its working stroke. The work-support thus not only prevents the operation of the machine upon an improperly positioned work-piece, but also relieves the operator's hands from all function of supporting and guiding the work-piece during the working stroke, thus making it practicable to utilize the separated manual switches to compel removal of the hands out of harm's way.

As shown in Fig. 4, the electric current from the lines 81, herein alternating current, for example of 110 v., is supplied to the solenoid windings 83 through an auto-transformer 85 whereby through movement of the sliding contactor 87 the voltage impressed on the windings of the coil 83 is varied to a practically infinite degree from zero to say 135 volts or any desired top figure. This of course varies in substantially direct proportion the power of the solenoid and hence the power of the blow or pressure exerted by the tool upon the work-piece. The contactor

87 being actuated by shaft 89 and hand-knob 91, the provision of a pointer 93 on the shaft 89 working in conjunction with a fixed scale indicated at 95 located on the housing of the auto-transformer, permits easy attainment of any desired relative degree of force of the blow or pressure exerted by the tool in its descent by simply turning the knob, and the relative value of this force is thus predetermined, as well as being capable of instant change of known degree, thus also making it possible to reinstate any given degree of force after change to a different strength of blow, as for the performance of different functions. The use of the auto-transformer to control the wattage input to the solenoid windings is especially suitable for the purpose because the increase in the strength of the blow of the tool is more nearly in direct proportion to the amount of advance of the sliding contactor by manipulation of the knob 91; i. e., the auto-transformer gives more nearly a straight-line character of control of the variation of the strength of the blow, than other types of current control.

The electric current to operate the device is supplied to the circuit illustrated in Fig. 4, through a connection applied to the prongs 97, Fig. 3, mounted on a disk 99 of insulating material fixed to the housing of auto-transformer 85.

A slot 101, Fig. 1, formed obliquely in the web of standard 3, forms a convenient hand-grip for lifting and carrying the device, which is essentially light and portable.

While I have illustrated and described a certain form in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular form shown, or to the details of construction thereof, but what I do claim is:

1. A power press having in combination a work support, a standard extending from the work support, a slide on the standard having a capacity for adjustment toward and from the work support, and a solenoid and a tool-carrying plunger actuated by the latter both mounted on the slide.

2. A power press having in combination a solenoid, a tool-carrying plunger actuated thereby, an electric circuit supplying actuating current to the solenoid, a work support, a normally open circuit-maker in the said circuit, means

in connection with the work support closing the circuit-maker only when the work is properly located on the work support, and two other normally open circuit-makers in the same circuit each requiring the pressure of one of the operator's hands in order to close the circuit to the solenoid.

3. A power press having in combination a base, a standard thereon, a slide adjustable on the standard toward and from the base, a solenoid fixed on the slide and having an armature movable toward and from the base, guide means carried by the slide, a tool-carrying plunger reciprocating in such guide means in line with the movement of the armature and engaged and moved by the armature in the latter's movement toward the base but not so moved in the opposite direction, and spring means on the slide urging the plunger toward the armature and away from the base.

CONRAD H. BENOIT.

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