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[54] COMPOUND DIE FOR PUNCHING SHEET MEMBERS FROM CIRCULAR BLANKS IN PUNCH PRESSERS WITH VERTICAL DISPOSITION OF BLANKING PLANES

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[52] **U.S. Cl.**.....**83/133,** 83/228, 83/373, 83/374, 83/384, 83/446, 83/449

[51] **Int. Cl.**.....**B26d 7/02**

[58] **Field of Search**.....83/133, 140, 228, 373, 384, 83/418, 420, 446, 449, 459, 374, 451, 621

[56] **References Cited**

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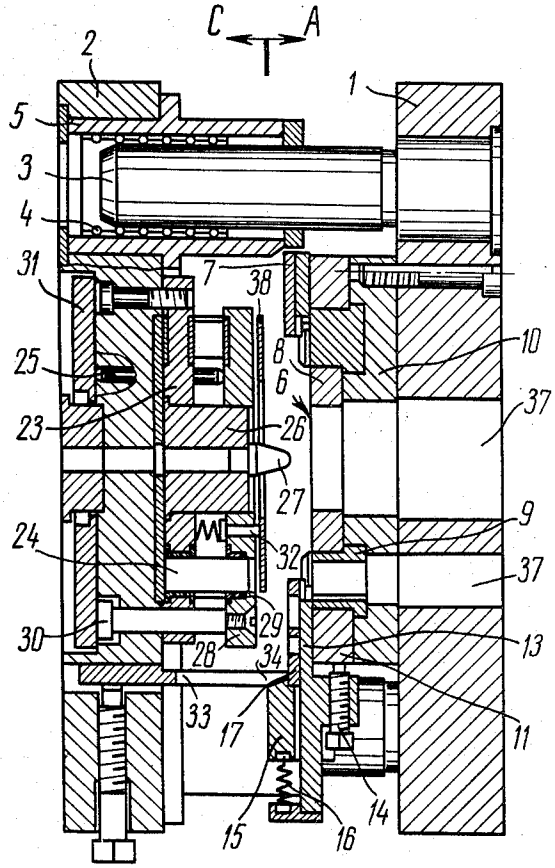
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[57] **ABSTRACT**

Compound dies for punching sheet members from circular blanks in punch presses with a vertical disposition of the blanking planes. The compound die has a movable plate provided with punches, a lifter for removing a completed member and a means for centering the blank relative to the female die. The female die is arranged on a stationary plate the lower portion of which is provided with supports for holding the blank on the stationary support. The stationary plate has a device for holding the blank against the face of the female die comprising at least two movable holder. These holders are positioned in the blanking plane in opposite relationship and along an axis perpendicular to the direction of movement of the blank.

2 Claims, 5 Drawing Figures



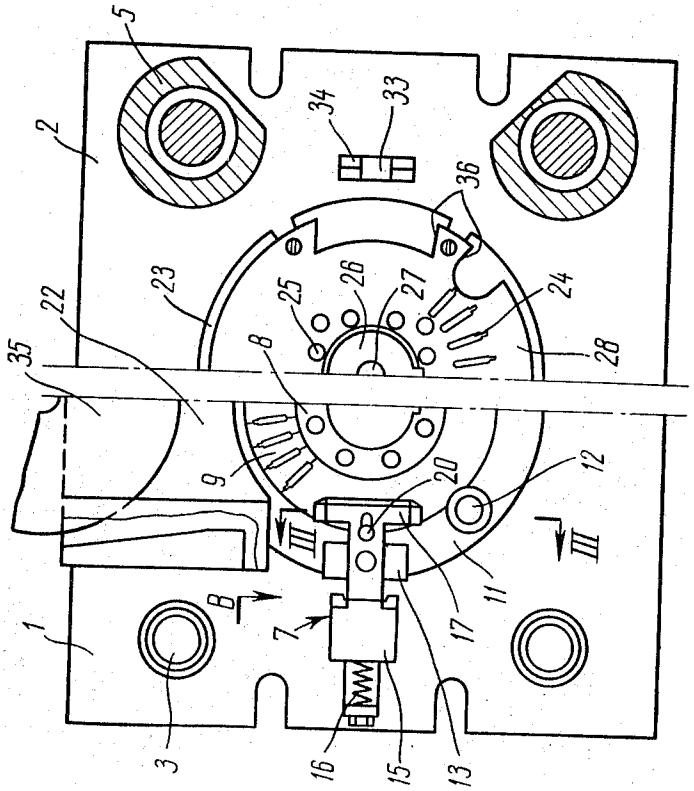


FIG. 5

FIG. 2

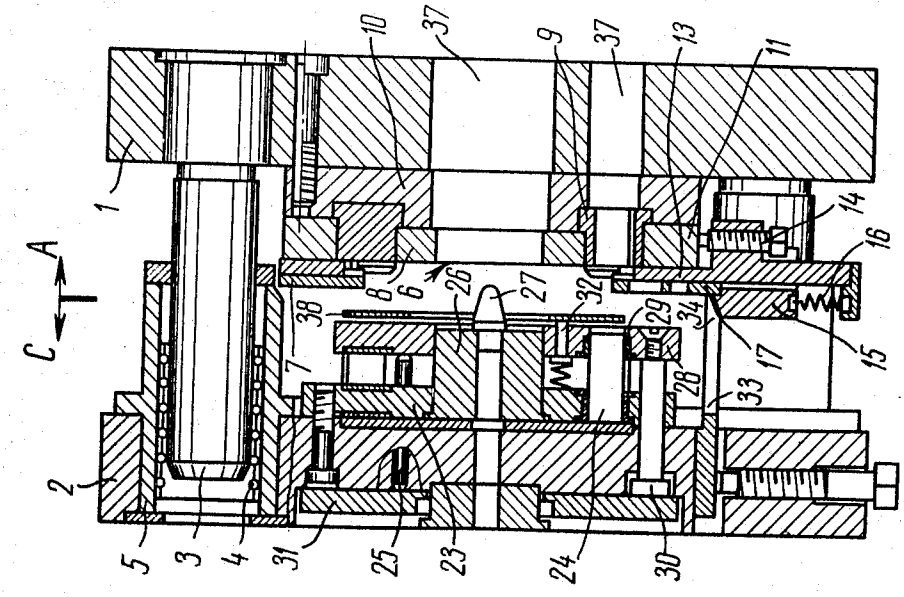


FIG. 1

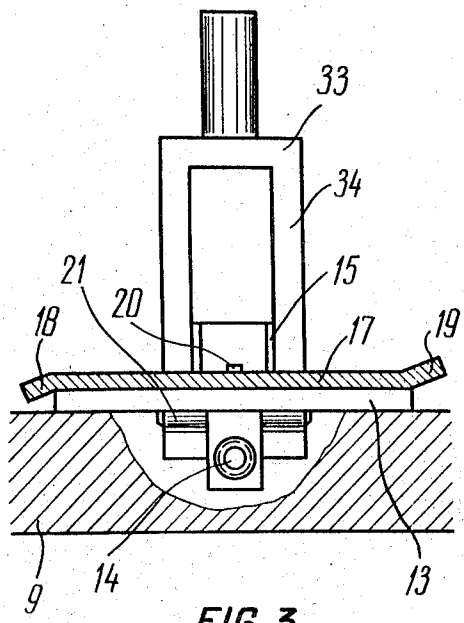


FIG. 3

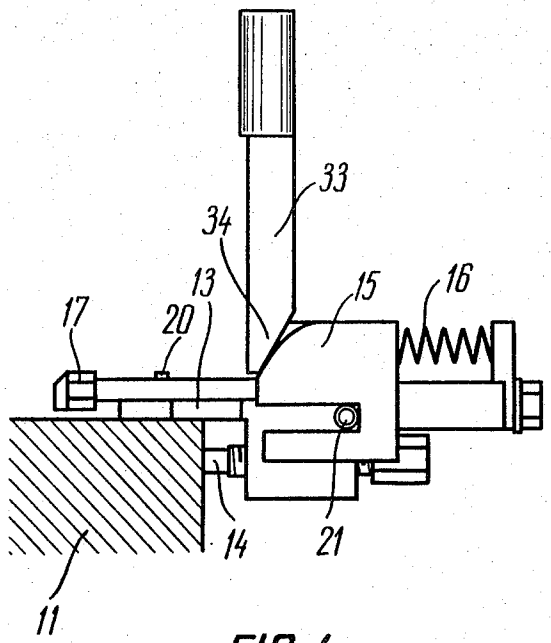


FIG. 4

COMPOUND DIE FOR PUNCHING SHEET MEMBERS FROM CIRCULAR BLANKS IN PUNCH PRESSERS WITH VERTICAL DISPOSITION OF BLANKING PLANES

The present invention relates to presses with a vertical disposition of the blanking planes employed for punching concentrically-shaped sheet members from circular blanks and, more particularly, the invention relates to compound dies used in such presses. The proposed dies can be used for punching rotor laminations of induction motors.

Known in the art is an automatic punch press with at least two dies located one above the other so that their blanking planes are positioned in one vertical plane. This press is suitable for punching out a sheet member in the lower die from a circular blank fed therein from the upper die. In this punch press the lower die is made in the form of a conventional compound die comprising a stationary plate with a female die and supports arranged in the lower portion of the plate and holding the blank on the female die and a movable plate carrying punches, a lifter for removal of a ready article and means for centering the blank relative to the female die.

However, this die was mainly utilized for the blanking in a horizontal or slightly sloping position, i.e. at the horizontal or slightly inclined blanking planes.

A setting of the known die in such a manner that its blanking planes are positioned vertically does not provide for holding a circular blank on the surface of the female die when said blank is fed into the die from above. The blanks can drop out during the opening of the die.

An object of the invention is to provide such a compound die with vertically disposed blanking planes for punching sheet members from circular blanks, preferably laminations of magnetic circuits of electric machines by means of a punch press which will make it possible to hold the circular blanks, fed into the die from above, against the vertical surface of the female die.

Another object of the invention is to provide such a die which will not allow the blanks to fall out from the open die and to keep them centered relative to the center of the female die.

These and other objects of the invention are attained by providing a die for punching sheet members from circular blanks in punch presses with a vertical disposition of the blanking planes comprising a stationary plate with a female die and supports located in the lower portion of the plate and holding the blank on the female die and a movable plate carrying punches, a lifter for removing a completed member, and an attachment for centering the blank relative to the female die; according to the invention, the stationary plate is provided with a device comprising at least two movable holders disposed within the blanking plane opposite each other and along can axis perpendicular to the direction of movement of the blank, said holders being used for holding the blank against the face of the female die.

It is expedient that each of the movable holders is made in the form of a spring-loaded wedge carrying an S-shaped plate whose lower end is bent towards to the face of the female die and the upper end is bent in the opposite direction.

It is also expedient that the movement of each holder is carried out depending on the travel of the movable plate of the die by means of a wedge-shaped lever one end of which is rigidly secured to the movable plate, while the other end is in a direct contact with the holder when the plates approach one another.

Such a construction provides for the possibility of automatically punching sheet members from circular blanks in punch presses with vertical blanking planes by means of holding the circular blanks, fed into the die from above, on the face of the female die and by preventing the blanks from a premature fall-out from the blanking zone and by centering the blank relative to the center of the female die.

This becomes possible due to the fact that the movable holders with S-shaped plates hold the circular blanks, fed into the die from above, on the surface of the female die up to the movement of such an approach of the movable and stationary plates moving towards each other when the fall-out of the blank is impossible.

Other objects and advantages of the invention will be apparent from a description of a preferred embodiment of the invention in the form of a die for punching rotor laminations of induction motors from circular blanks, reference being made to the appended drawings, in which.

FIG. 1 is a plan view of the die according to the invention in a horizontal section;

FIG. 2 is a view along the arrow A in FIG. 1 (the stationary part of the die);

FIG. 3 shows a device for holding a blank on the face of the female die in sectional view taken along the line III—III in FIG. 2;

FIG. 4 is the same view taken along the line indicated by the arrow B in FIG. 2; and

FIG. 5 is a view taken along the line indicated by the arrow C in FIG. 1 showing the movable part.

The proposed compound die comprises a stationary plate **1** (FIG. 1) and a movable plate **2** interconnected by columns **3**. One end of each column **3** is rigidly connected to the stationary plate **1**, while the other end is mounted in ball bearings **4** of a bushing **5** rigidly connected to the movable plate **2**.

The stationary plate **1** carries a female die **6** and a holding device **7** for holding the blank on the face of the female die.

The female die **6** consists of a central portion **8** used for punching a shaft aperture and vent openings in the rotor lamination. Located about the central portion **8** are sectors **9** used for punching slots in the rotor lamination. The members of the female die, i.e., the central portion **8** and the sectors **9** are secured in the female die holder **10** by means of screws (not shown) and a ring **11**.

Mounted on the ring **11** in the lower portion thereof is a pair of supports **12** (FIG. 2) supporting the blank from below when the latter is near the female die.

The device **7** for holding the blank against the face of the female die comprises two holders located in the blanking plane opposite to each other and along an axis perpendicular to the direction of movement of the blank. Each of these holders consists of a support **13** secured to the ring **11** and bearing thereupon by means of an additional support in the form of a screw **14** (FIG. 1). Mounted on the support **13** (FIGS. 3 and 4) is a wedge **15** loaded by a spring **16**. The wedge **15** carries an S-shaped plate **17**. The lower end **18** of the plate **17** is bent towards to the face of the female die **6**, while the upper end **19** of the plate **17** is bent away from the face of the female die so that the circular blanks, fed from above, slide to the face of the female die and are held there up to the moment of punching.

Pins **20** and **21** limit the travel of the wedge **15** with the plate **17**.

Placed above the stationary plate **1** (FIG. 2) is a guide chute **22** defining a slit somewhat tapering to the bottom both in thickness and width. The guide chute **22** guides the blank deposited from above to the face of the female die and directs the blank to the holders of the device **7**.

The movable plate **2** (FIG. 1) is provided with a punch holder **23** carrying punches **24** for punching slots, punches **25** for punching vent openings and a punch **26** for punching a central shaft aperture in the blank, thus transforming the blank into a rotor lamination of an induction motor.

Rigidly fixed in the center of the punch **26** is a device **27** for centering the blank relative to the female die, said device being in the form of a rounded conical pin. The pin diameter corresponds to the size of the central opening of the circular blank fed into the die.

The movable plate **2** also carries a lifter **28** for removing a completed rotor lamination from the punches **24**, **25** and **26**. The lifter **28** is capable of moving relative to the punches **24**, **25** and **26**, for which purpose it is provided with respective openings. The openings of the lifter **28** corresponding to the punches **24** have a plastic insert **29** designed for reducing the

friction between the movable parts, for providing an additional support for the punches **24** and for increasing the accuracy of punching the slots.

The lifter **28** is connected to pushers **30** bearing upon a ring **31** associated with the mechanism (not shown) of the punch press which synchronizes the removal of the completed rotor laminations with the travel of the slides.

The lifter **28** is provided with a mechanism in the form of spring-loaded pushers **32** for separation of the completed rotor laminations from the surface of the lifter **28**.

A pair of wedge-shaped levers **33** is rigidly mounted in the movable plate **2**. The end **34** of each lever **33** is in direct contact with the corresponding wedge **15** of the device **7** during the travel of the plates towards each other (as shown in FIG. **4**).

The proposed die operates as follows.

A circular blank **35** (FIG. **2**) with a central opening is fed into the die from above, passing through the guide chute **22** which moves the blank close to the face of the female die and directs it into the holders of the device **7**.

In the die, the blank is supported by the supports **12** close to the face of the female die **6** by means of the S-shaped plates **17**.

When the movable plate **2** (FIG. **1**) approaches the stationary plate **1**, the columns **3** move within the ball bearings **4** of the bushing **5**, and the end **34** of each lever **33** contacts a corresponding wedge **15** of the device **7** and to some extent moves the holders with the S-shaped plates **17** to the periphery of the stationary plate **1**. At the same time, the mechanism **24** enters the central opening of the circular blank, thus accurately centering the blank relative to the punching parts of the die.

Now the movable plate **2** is so close to the stationary plate **1** that a fall-out of the circular blank, bearing on the supports **12**, from the blanking zone is practically impossible, and the lifter **28** presses the blank against the face of the female die. The lifter **28** is provided with recesses **36** (FIG. **5**) preventing it from contact with the supports **12** and holders of the device **7**.

When the plates **1** and **2** (FIG. **1**) are completely closed, the punches **24** enter the sector **9**, thus punching slots in the circular blank, the punches **25** and the punch **26** enter the openings of the central portion **8** of the female die **8**, thus punching vent openings and shaft aperture respectively so that the circular blank is transformed into a rotor lamination of an induction motor.

The scrap produced by the punching of the slots, vent opening and central aperture drop through the holes **37** provided in the stationary plate **1**.

In the process of punching during the approach of the plates **1** and **2** and the interaction of the punches **24**, **25** and **26** with the blank and female die **6**, the lifter **28** moves relative to the punches **24**, **25** and **26** approaching the punch holder **23**.

When the movable plate **2** moves away from the stationary plate **1**, the completed rotor lamination **38** remains on the punches **24**, **25** and **26**. When the plates **1** and **2** separate almost completely, the device of the punch press synchronizing the removal of the completed articles with the movement of the sliders through the ring **31** and pusher **30** acts upon the lifter **28** returning it to the initial position. While returning to the initial position the lifter **28** removes the completed rotor lamination from the punches **24**, **25** and **26**. The pushers **32** of the lifter **28** separate the completed rotor lamination from the lifter surface, and the rotor lamination slides away from the lifter onto a mechanism (not shown) for transportation of the completed lamination to an assembly line.

We claim:

1. A compound die for punching sheet members from circular blanks in punch presses with a vertical disposition of the blanking plane, said die comprising: a stationary plate, a movable plate opposite said stationary plate, a female die positioned on said stationary plate, supports located in the lower portion of said stationary plate for supporting a blank on the stationary plate, punches positioned on said movable plate, a lifter for removing a completed member positioned on said movable plate, means on said movable plate for centering said blank relative to said female die, a device on the stationary plate for holding the blank against the face of said female die, said device including at least two movable holders located in the blanking plane in opposite relationship and along an axis perpendicular to the direction of movement of said blank, each movable holder comprising a spring-loaded wedge carrying an S-shaped plate the lower end of which is bent towards the face of the female die and the upper end of which is bent in the opposite direction.

2. A compound die according to claim **1** comprising means for the movement of each of the holders including a wedge-shaped lever having one end which is rigidly secured to the movable plate and an opposite end which directly contacts said wedge during the approach of the movable plate towards the stationary plate.

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