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SAFETY BRIEF

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On the Safety of Motorcycle Side Stands

by Dror Kopernik[1]

Synopsis

When a motorcycle is banked to the left with its kickstand in the down, or park position, the contact between the kickstand and the pavement can cause the driver to lose control. Some kickstand designs retract during such a turn without interfering with the driver's control. A reprint of Dror Kopernik's SAE Paper (No. 840905) is presented which explores the design parameters affecting kickstand retraction.*

Drill Press Guards

by William G. Switalski[2] & Ralph L. Barnett[3]

Synopsis

An investigation into the safety of drilling has trevealed a number of shortcomings of drill press safety guards. The results of Triodyne's research have been reported by the National Safety Council in ***National Safety News******. The article is reprinted here. It is significant that the National Safety Council has withheld recommendation of the subject guards in all of their subsequent publications.*

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SAE Technical Paper Series

840905

On the Safety of Motorcycle Side Stands

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840905

On the Safety of Motorcycle Side Stands

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ABSTRACT

The side stand is a common means of supporting a parked motorcycle. Motorcycle riders may, on occasion, forget to retract the stand before riding. The potential of an unretracted stand hitting the ground and interfering with the rider's control during a turn has been recognized for a long time. Different designs have been tried in an effort to reduce or eliminate the problem. Laboratory and road tests show the effects of geometrical design parameters on the retractability of side stands and define those parameters having the greatest influence.

THE CONVENTIONAL MOTORCYCLE SIDE STAND consists of a steel rod held in both parked and stowed positions by an overcentered spring. It is convenient to use and provides a stable support for the motorcycle. It can, however, be dangerous.

Since stowing the stand is not a necessary condition for the operation of the motorcycle, riders may occasionally forget to stow the side stand and ride. Contact between the bottom of the stand and the pavement during a turn can result in loss of control.

Different side stand designs, attachments, mechanisms and rider warning systems intended to minimize the liklihood of riding with the stand down have been proposed, manufactured and installed on motorcycles. Some side stands retract automatically when the motorcycle is lifted off the support. Some retract if they contact the ground when the motorcycle is moving forward. Still others are fit with electrical interlocks, warning devices or special retracting mechanisms.

Road and laboratory tests of side stands reveal significant differences in their tendency to retract and in their interference with motorcycle control upon contact with the ground.

This paper will review the literature and safety standards relating to motorcycle stands, state-of-the-art stand designs, and design factors found to influence the retractability of these devices.

THE SIDE STAND PROBLEM - LITERATURE REVIEW

Side stands for bicycles and motorcycles have been described in the patent literature since the late 1800's. Examples include:

1891 - Frederick G. Taylor and R.L. Granston, "Bicycle Support",U.S. Patent 456,347

> "The object of this invention is to provide a new and useful device for supporting bicycles in an upright position, which...can be conveniently carried on the bicycle in a position which will not interfere with the movements of the rider."

1926 - E.C. Henderson, "Leaning Support for Motorcycles and the Like",U.S. Patent 1,584,096 (Figure 1)

> "In my invention, I have pivoted a single support arm to one side of the vehicle frame,...while the operator is seated thereon and balancing the vehicle in an upright position...the operator uses one of the feet to start moving the support bar back, and a tension spring forces the said support bar into the final resting place..."

The hazard associated with side stands is also discussed in the patent literature. The earliest is:

1928 - W.S. Harley and Arthur R. Constantine assignors to Harley Davidson Motor Co., Milwaukee, "Cycle Support",U.S. Patent 1,675,551 (Figure 2)

> "Should the operator forget to move the support or stand to inoperative

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position, no difficulties could occur, for the reason that said support or stand will automatically become released from the notch 18 of the catch plate 17 when the motorcycle is put in vertical position."

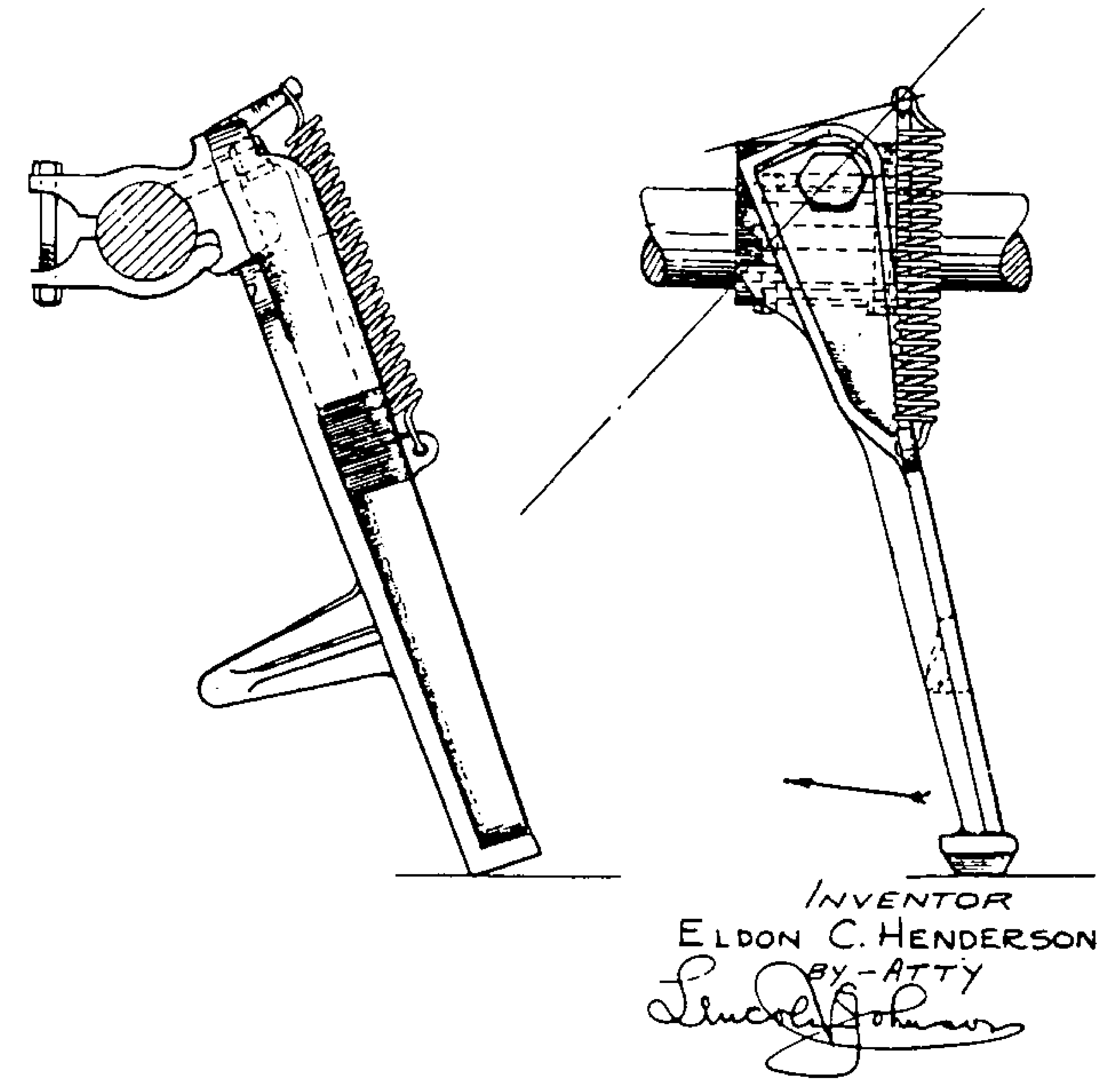

Figure 1: E.C. Henderson,U.S.Patent 1,584,096

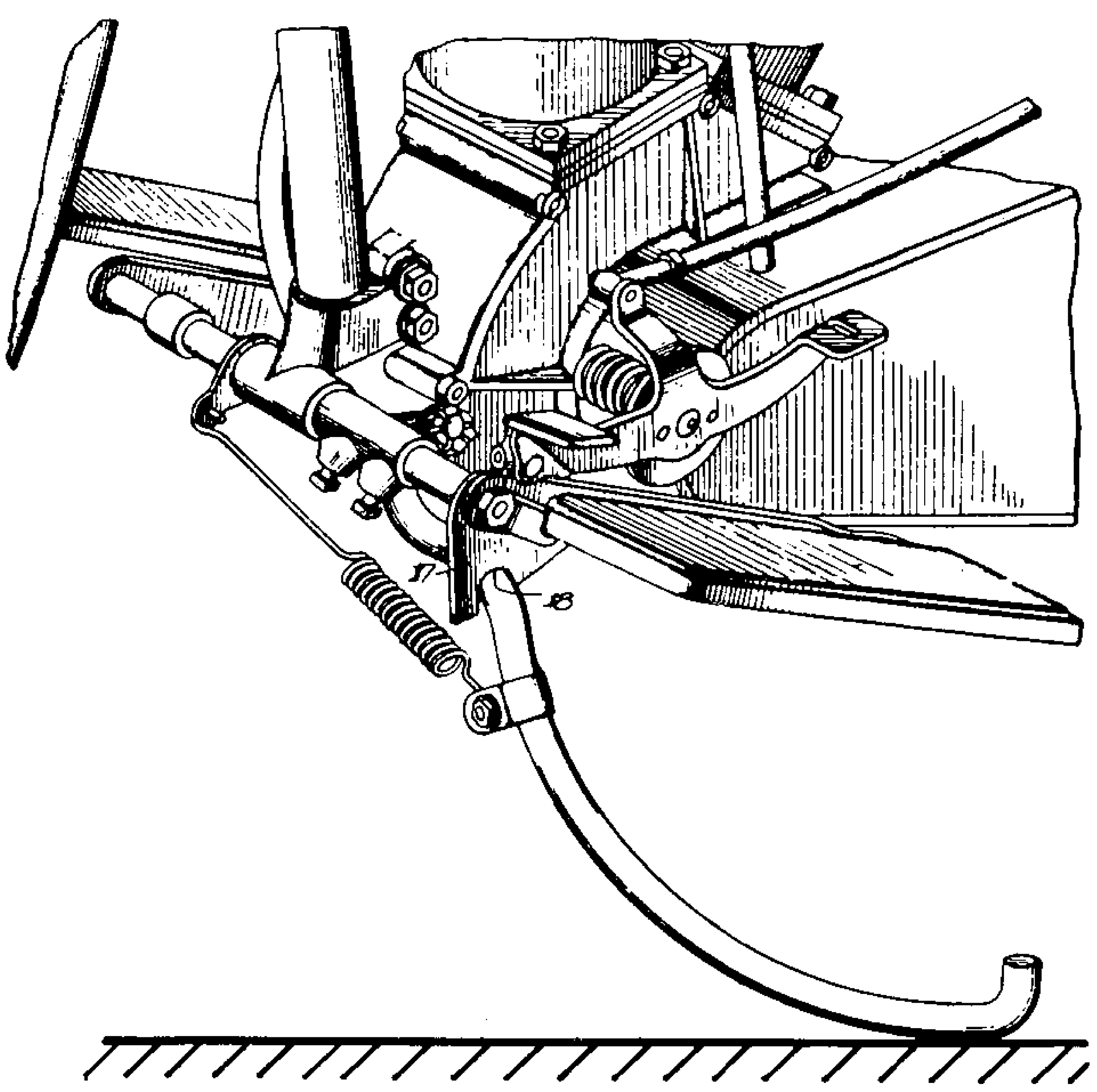

Figure 2: W.S. Harley & Arthur R. Constantine, U.S. Patent 1,675,551

Later examples are:

1942 - Milton V. Andrews, "Automatic Motorcycle Stand Retractor," U.S. Patent 2,300,762

"Often the cyclist neglects to move the standard to its raised position and when a banked turn is made the standard strikes the ground and causes the motorcycle to be thrown to the ground, generally with serious consequences to both cyclist and the motorcycle."

1975 - Sato Minoru, et al assigned to Honda Giken Kogyo Kabushiki Kaisha, Japan, "Side Stand for Motorcycle," U.S. Patent 3,918,743

"It takes place very often that riders of motorcycles start running their motorcycle without levelling or retracting the side-stand to its running position, so that...at the time of the motorcycle being inclined by a sharp turn, etc., the motorcycle inevitably overturns by the shock of the touch."

1978 - Yorio Yamazaki, assigned to Kawasaki Jukogyo Kabushiki Kaisha, Japan, "Stand Device for a Two-Wheeled Motorcycle," U.S. Patent 4,073,505

"In the event that the driver forgets to move the stand from its operative position to its inoperative position when he starts the engine and brings the motorcycle to running condition, there is the danger of impinging on the surface of the road by the forwardly tilted end of the stand, for example, which causing to overturn the motorcycle and bring unexpected injury on the driver."

These patents propose side stand designs to reduce or eliminate the hazard. Such designs have gained popularity in the last few years. The operational concepts and characteristics of some devices will be discussed in this paper.

INTERNATIONAL SAFETY STANDARDS

Several international safety standards address the side stand arrangement on motorcycles.

U.S. Federal Motor Vehicle Safety Standard No. 123, "Motorcycle Controls and Displays," effective Sept. 1, 1974, states that: A stand shall fold rearward and upward if it contacts the ground when the motorcycle is moving forward."

The German Traffic Regulation No. 734, "Stands for Motorcycles without Sidecars" (1976)*, contains a section almost identical to the American version, and in addition, it requires that powered motion of the motorcycle be able to occur only when the side stand is fully retracted unless the side stand is designed in such a way, that when folded down, it does not generate any safety risk.

The Swiss November 1976 Amendment of "The Construction and Equipment of Road Vehicles."* states that motorcycles must be provided with a parking stand which does not damage the road surface. The stand must automatically fold backward when the vehicle is driven.

The November 1, 1978 revision of the Norwegian Regulation Regarding Motor Vehicles, Section 34, Chapter II, B* states that for new motorcycles, effective January 1979, the parking support of a motorcycle must be made so that when the weight of the motorcycle is removed from it, it returns automatically to a resting position; or it must be placed in a resting position before the machine can be driven.

SOLUTIONS TO THE SIDE STAND PROBLEM - STATE - OF-THE-ART

Different concepts have been applied to deal with the hazard of an unretracted side stand.

a) Instructional Methods - Instructions to stow the side stand prior to riding, and warnings describing the serious consequences of failing to do so have appeared in manuals and other literature since the early seventies.

Kawasaki Owner's Manuals have warned since 1973 that:

> "Forgetting and leaving the side stand down while riding could cause an accident."

Suzuki Owner's Manuals instruct owners of late seventies models:

> "Before starting off, turn back the prop stand fully to its normal position."

Warnings and instructions are expected to reduce riders' forgetfulness by making them aware of the danger associated with leaving the side stand in a parked position.

b) Reminder Devices - Reminder devices inform the rider that the side stand is down. They do not, however, physically interfere with the operation of the motorcycle.

Most people are familiar with buzzers used in automobiles to remind drivers of unbuckled seat belts or keys left in the ignition. Lights are used to inform truck drivers of insufficient air pressure, which may reduce the braking ability of their vehicle.

Recently side stand warning lights on the motorcycles' instrument panel have been introduced.

The 1982 Kawasaki KZ 550 GP, warns the rider that the side stand is down by turning instrument panel lights on and off. In 1977, Marion Z. Miller patented a device for actuating the motorcycle's horn if the side stand is down, the ignition is on, and the motorcycle is in the driving position. ("Safety Device for a Motorcycle, "U.S. Patent No. 4,016,538.)

c) Interlocking Systems - Interlocking systems prevent the operator from riding the motorcycle with the side stand in the parked position.

In 1977 Shimanto Takshi patented a "Safety Device for a Motorcycle," U.S. Patent 4,010,379, assigned to Kawasaki Jukogyo Kabushiki Kaisha. Japan

> "An object of this invention is to provide a safety device for a motorcycle...to prevent the engine from starting when the motorcycle stand is in an operative position and to immediately stop the engine when the motorcycle stand is inadvertently moved to an operative position while the motorcycle is in operation... ...a safety device for a motorcycle which permits the idling of the engine or the starting of the engine in the neutral position of the transmission independent on the position of the motorcycle stand."

The 1981 Moto Guzzi Convert contains an electrical switch that prevents the engine from starting with the stand down. The side stand also activates a cable operated parking brake while in its parked position.

The Yamaha XJ 750J Model engine will not run with the side stand down unless the transmission is in neutral.

Interlocking systems interfere with the operation of the motorcycle when the stand is down but the operator must physically raise the stand to a stowed position.

d) Correcting (Passive) Systems - A correcting system will raise the forgotten stand to the stowed position without driver's action.

A Type I correcting system contains an auxiliary mechanism that raises the stand either prior to or at the very beginning of the motorcycle's forward motion. An automatic side stand return mechanism is described in the 1977, 1978 Kawasaki KZ-400 service manual. This mechanism is actuated by the movement of a pin mounted on the engine sprocket. If this sprocket rotates with the side stand down, the sprocket pin pushes a lever that, in turn, swings the side stand up through a rod and a drive lever.

A clutch activated mechanism has been used by Kawasaki on the 1983 AR125 LC and the 1984 KE-100 Models. This mechanism retracts the side stand as the clutch lever is depressed.

Bernd Hofman, in the 1964 East German Patent No. 18123 - "Motorscooter Stand with Safety Provision" - proposed a lever attached

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* C. Jeffries - Regulations for Motorcycle Side Stands: Switzerland, Germany (FR), Sweden, Norway, France, Italy, "THE"-Technical Help to Exporters, British Standards Institution, Report No. T876 (August 1979)

to the gear shifter shaft which contacts the side stand when first gear is engaged. This causes the stand to rotate about its pivot to a point at which the tension spring can pull the side stand to its raised position.

A Type II correcting system uses the friction forces between the stand and the ground generated by the motion of the motorcycle at operating speed to retract the stand.

The Harley Davidson design shown in Figure 2 is an example of such system. This 1928 patent describes:

> "...a cycle stand of a simple construction which will automatically lock itself in operative position when the cycle is leaned to a parking position and which will automatically become disengaged when the cycle is again brought to a riding position." such that, "...should the operator forget to move the support or stand to inoperative position...the first obstruction met, or the making of a turn to that side upon which said support or stand is located, will knock back said support or stand to its inoperative position."

The Honda rubber tipped stand in Figure 3 is another Type II correcting system. The Honda patent describes:

> "A side stand for a motorcycle wherein an auxiliary member is provided at one side of the side stand in a length which stretches fairly beyond the contact surface of the side stand when the motorcycle is set upright for running. Whereby, even if the rider forgets to retract or level the side stand, frictional contact between the bottom tip end of this auxiliary member and the ground surface causes the side stand to be retracted automatically while running... Said auxiliary member being such that, when the motorcycle is to be parked, a part thereof is bent or collapsed by the weight of the motorcycle body..."

A Type III device utilizes the ground friction force to retract the stand at the very beginning of motion. The BMW design in Figure 4 demonstrates the concept.

> "A side stand for a motorcycle comprising a member... . A free end of the side stand member is able to move upwardly, whilst in the parking position, relative to the motorcycle also against spring force over a limited angular extent... . the side stand member,...makes contact with the ground when that member is at the lower extreme of the said angular extent with the motorcycle upright...the side stand member is retracted automatically when the motorcycle starts

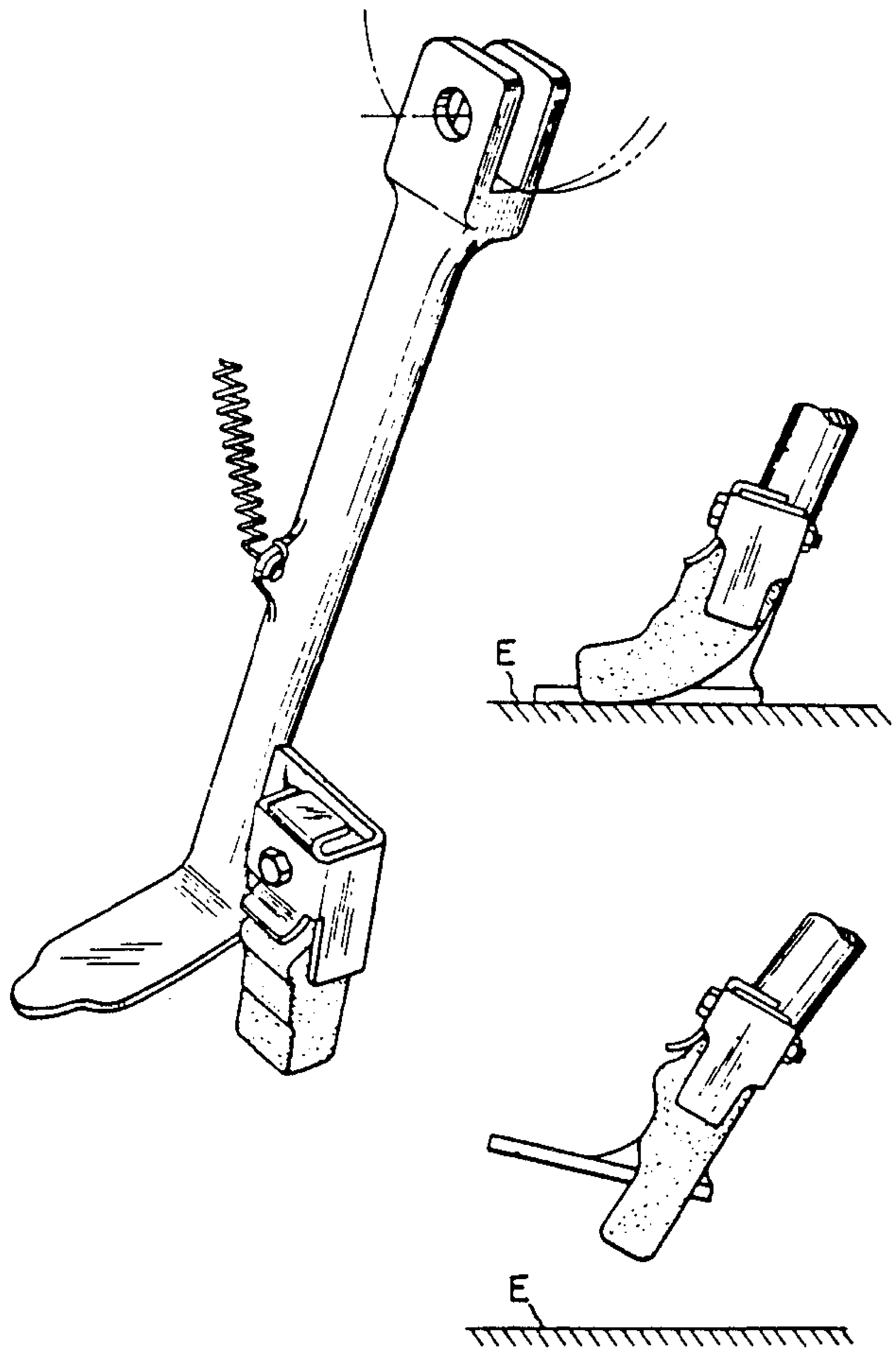


Figure 3: 1975 - Sato Minoru, et al. - "Side Stand for Motorcycle," U.S. Patent 3,918,743

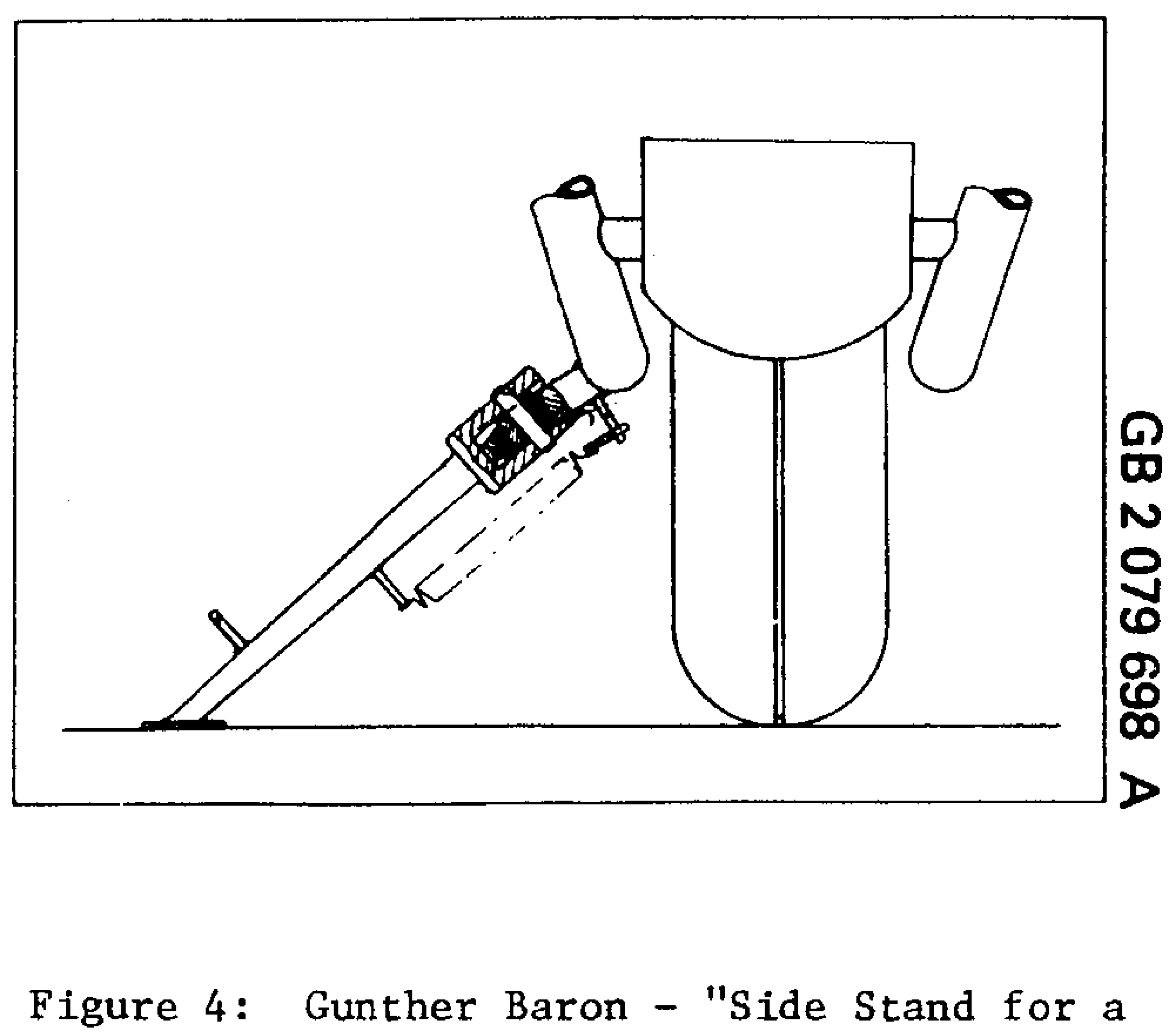


Figure 4: Gunther Baron - "Side Stand for a Motorcycle," UK Patent Application, GB 2 079 698 A, filed May 1981 by BMW

to move forward should the rider have forgotton to perform the retracting operation. ...when the motorcycle begins to move forward the frictional contact between the side stand member and the ground causes the side stand member to remain in contact with the ground for only a relatively short distance before it is pivoted into a less than dead centre position of the spring or springs. From this position it is retracted completely into the traveling position..."

e) Problem Elimination by Stand Modification
A BMW design introduced in the mid-seventies eliminates the overcentered arrangement of the side stand's spring.

The anchor point of the spring to the motorcycle frame is located such that the spring always pulls the stand into its stowed position. For parking, the stand is pulled down against the spring force and the motorcycle is then rested on it. The weight of the motorcycle is used to keep the stand in a parked position. As soon as the weight is removed, the stand retracts automatically.

SIDE STAND STUDIES

The Engineering Problem - The conventional side stand consists of a steel rod or bar, attached to a bracket which is welded or bolted to the left motorcycle frame tube. An overcentered spring arrangement keeps it down in a parked position. Its location and geometric design details vary with specific motorcycles. A side view of a typical side stand in the down position is shown in Figure 5.

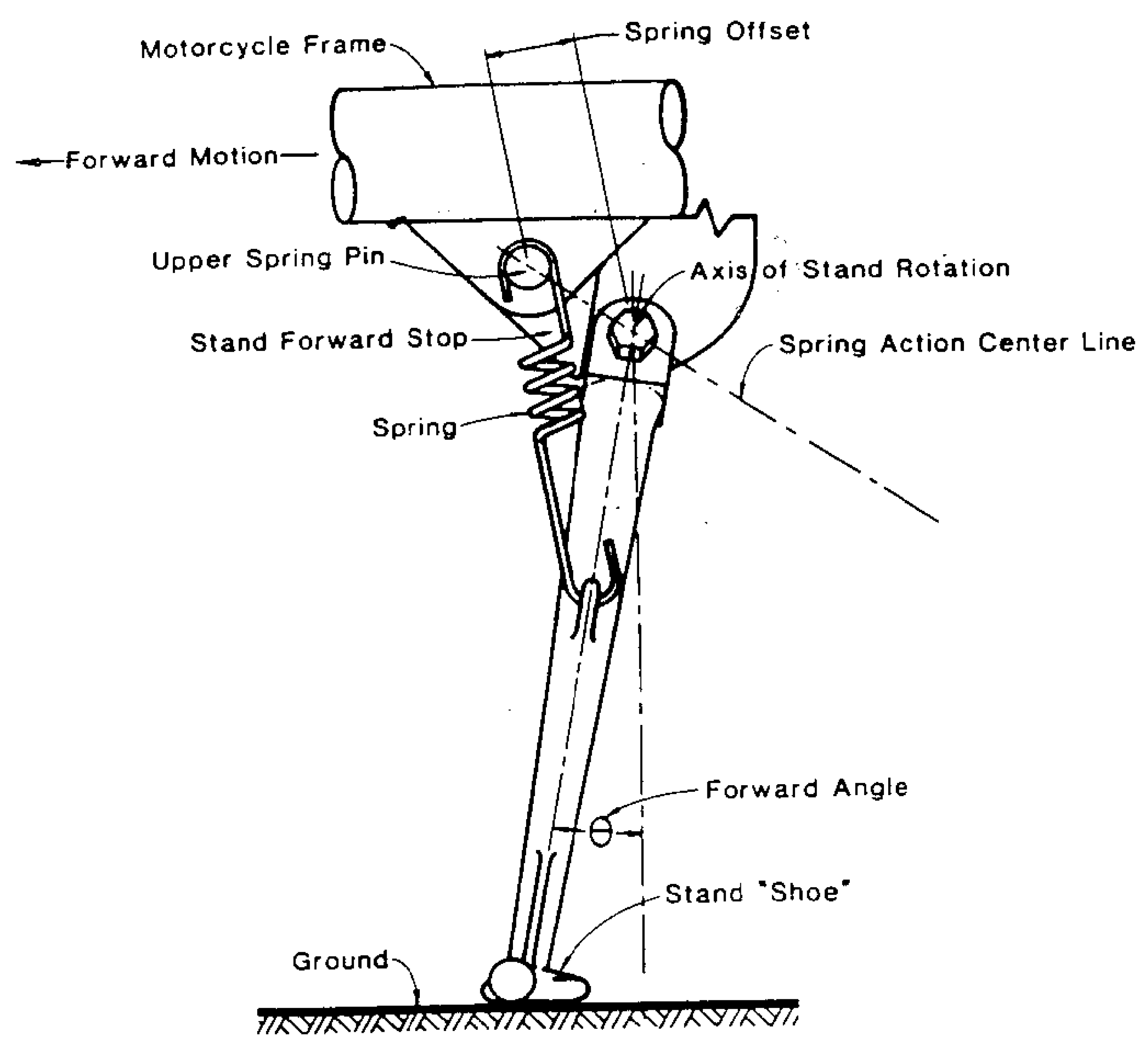


Figure 5: A typical conventional side stand

Figure 6 defines some of the geometrical design parameters of a side stand in a parked position when a moving motorcycle is leaning into it such that the stand "shoe" contacts the ground.

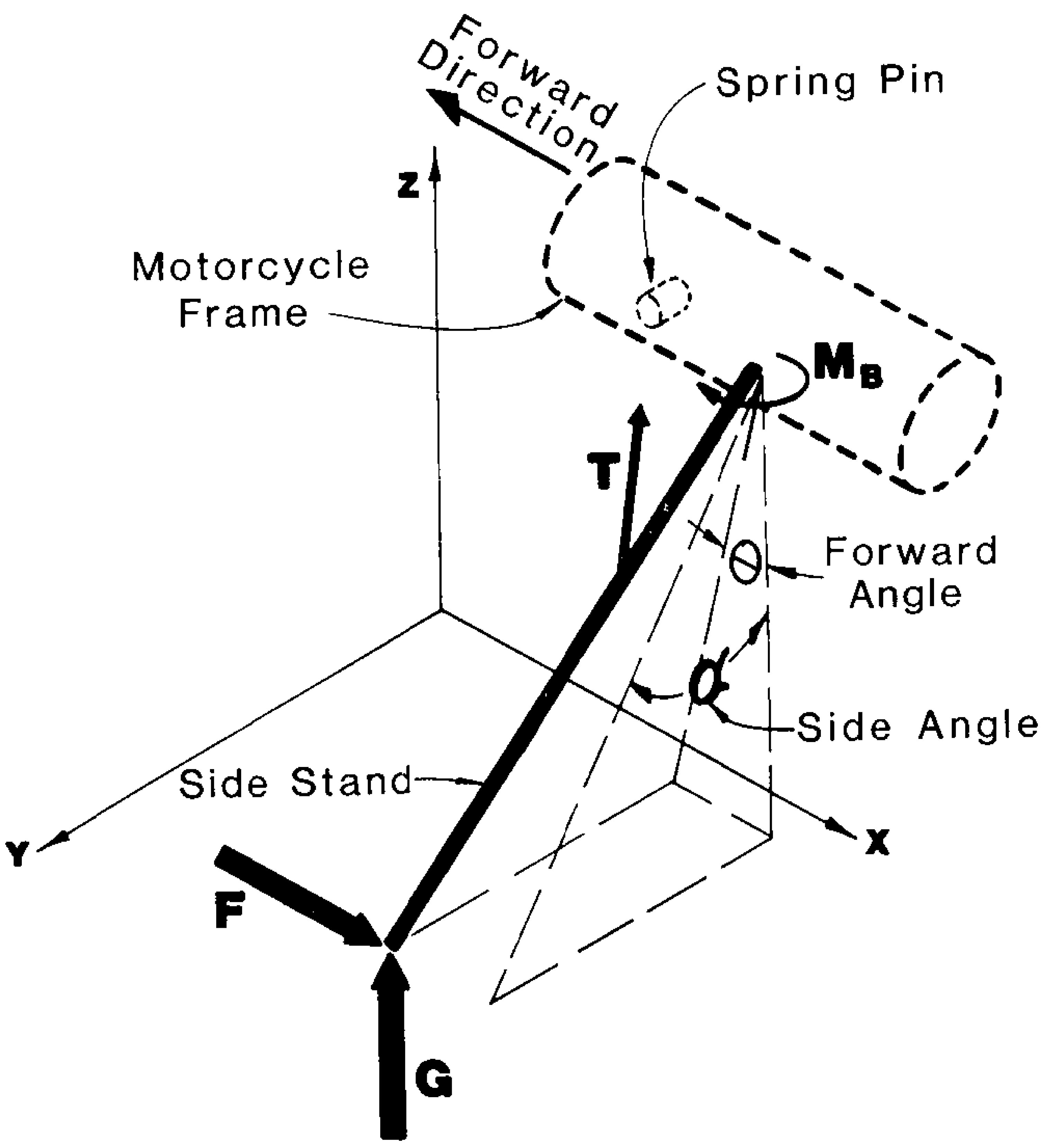


Figure 6: Side stand geometrical parameters

Where:

T - Spring tension at parked position

G - Ground reaction

M_B - Mounting Bracket friction moment

F - Ground friction force

Θ - Stand forward angle in parked position

α - Stand side angle in parked position

If the moving motorcycle is banked to the left and the stand comes in contact with the ground, the ground friction force F generates a moment M_F tending to rotate the stand toward its stowed position. The ground reaction G, however, generates a moment M_{Gh} in the opposite direction. The ground reaction also affects the mounting bracket friction moment M_B at the contact points (Figure 7).

If a side stand rotates from its parked position rearward without maintaining ground contact, its bottom describes an arc. Due to the forward angle the tip of the stand drops down until the stand is perpendicular to the motorcycle's direction of motion (for a stand 10 inches long with 15° forward angle and 45° side angle, the tip would drop almost 1/4 inch.) During further rotation of the stand, the stand "shoe" rises toward its stowed position (Figure 8).

In the case of a top mounted spring (Figure 9), the slack in the mount is absorbed upward. In this case M_F and M_{Gh} increase simultaneously immediately following contact with the ground. As a result, an increase in the mounting bracket friction moment M_B also follows.

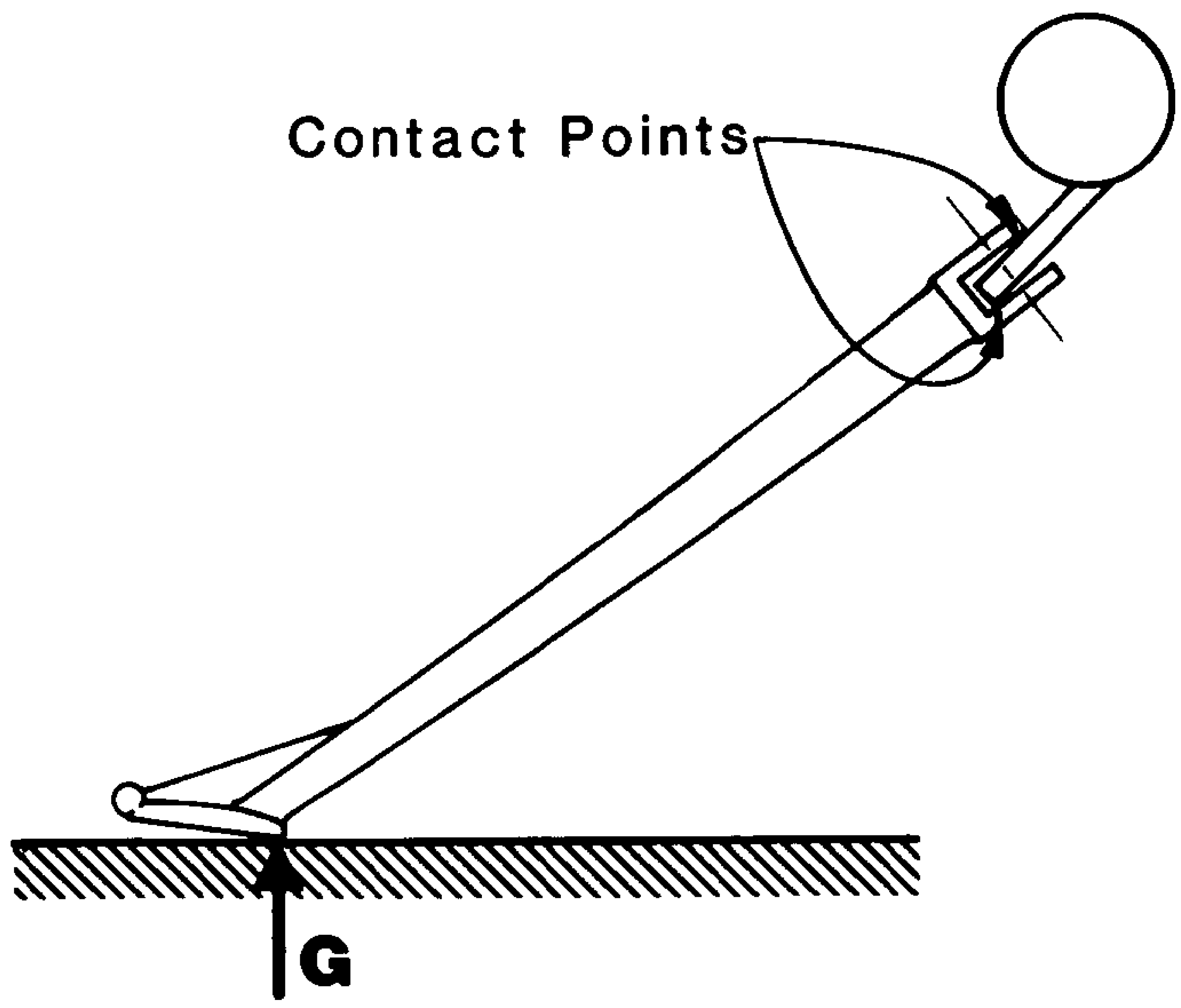


Figure 7: Ground reaction effect on mounting bracket

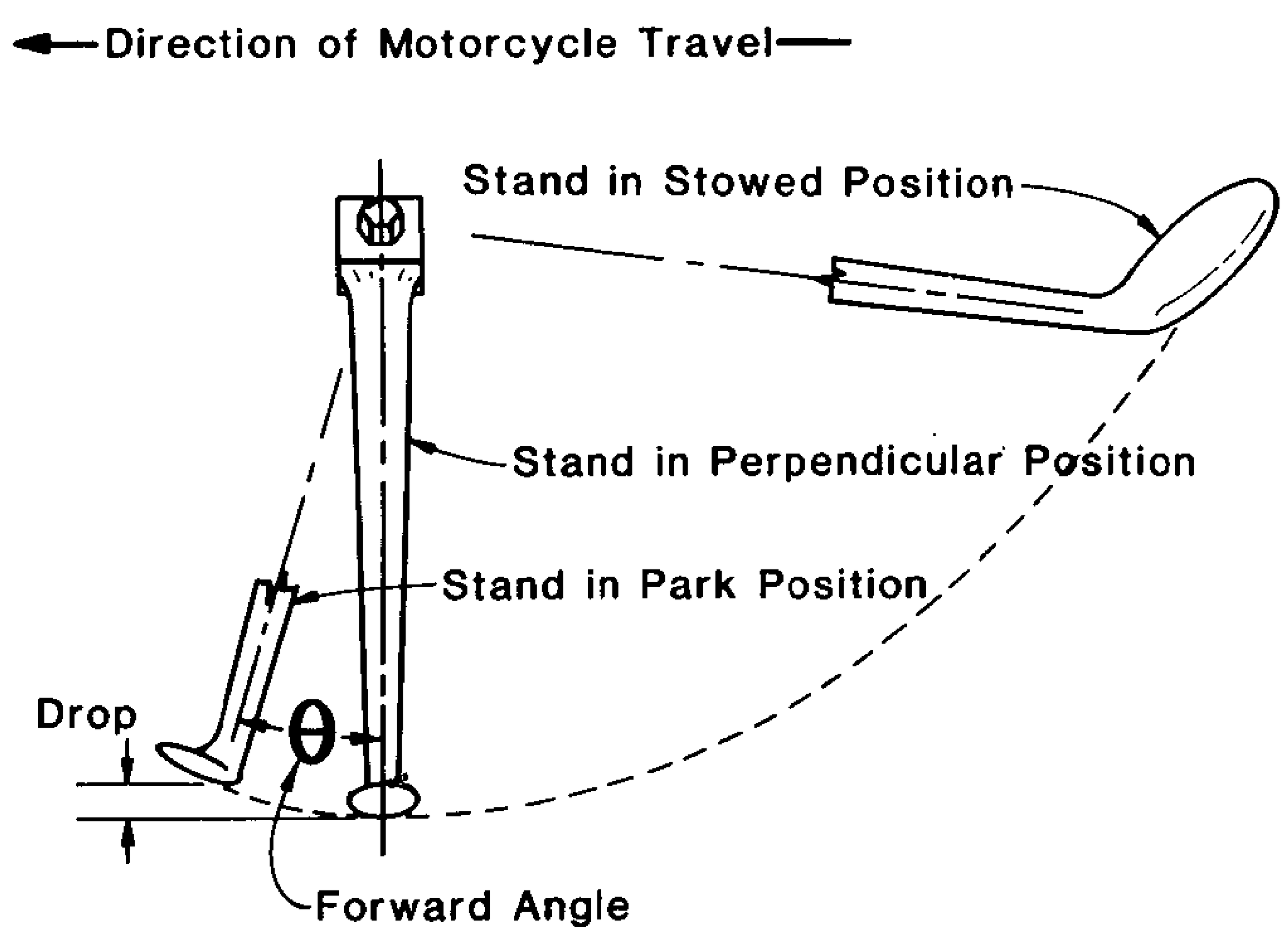


Figure 8: Stand motion from parked to stowed position

If ground contact is maintained as the side stand is forced rearward by the ground friction force F, the stand pivot is forced upward while the motorcycle moves forward (Figure 10). This lifts the motorcycle frame in a direction opposite to the lean and introduces a dynamic force or "jolt" that could be felt by the operator.

In the case of a bottom mounted spring (Figure 11), the slack in the mount is absorbed downward.

For a motorcycle entering a left hand turn with the stand in the parked position, the stand must move through the slack before stopping against the mounting bracket at the opposite side of its motion. While taking up the slack, the stand is floating and no forces are transferred from the ground to the motorcycle frame through the stand mount (Figure 12).

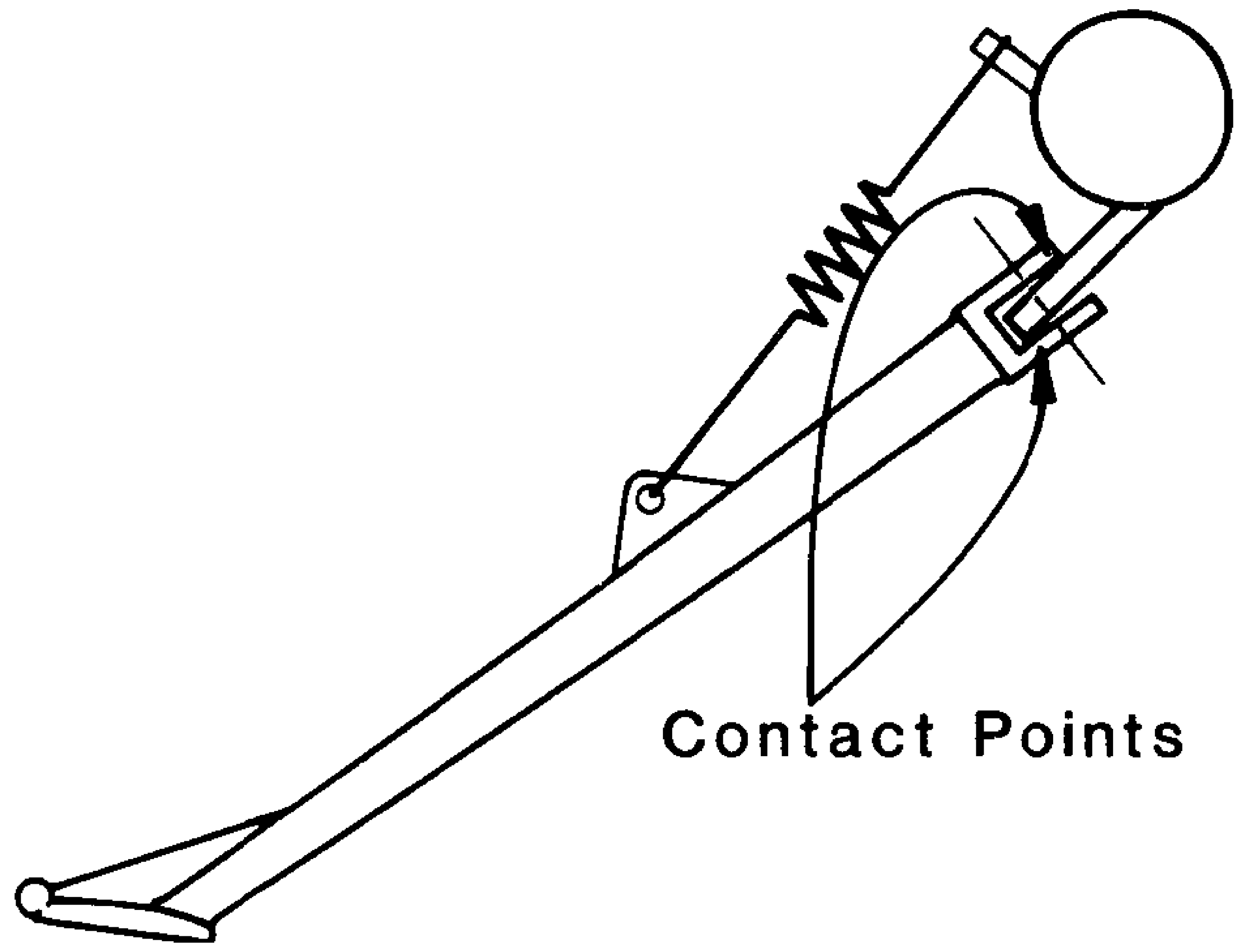


Figure 9: Effect of top mounted spring on mount

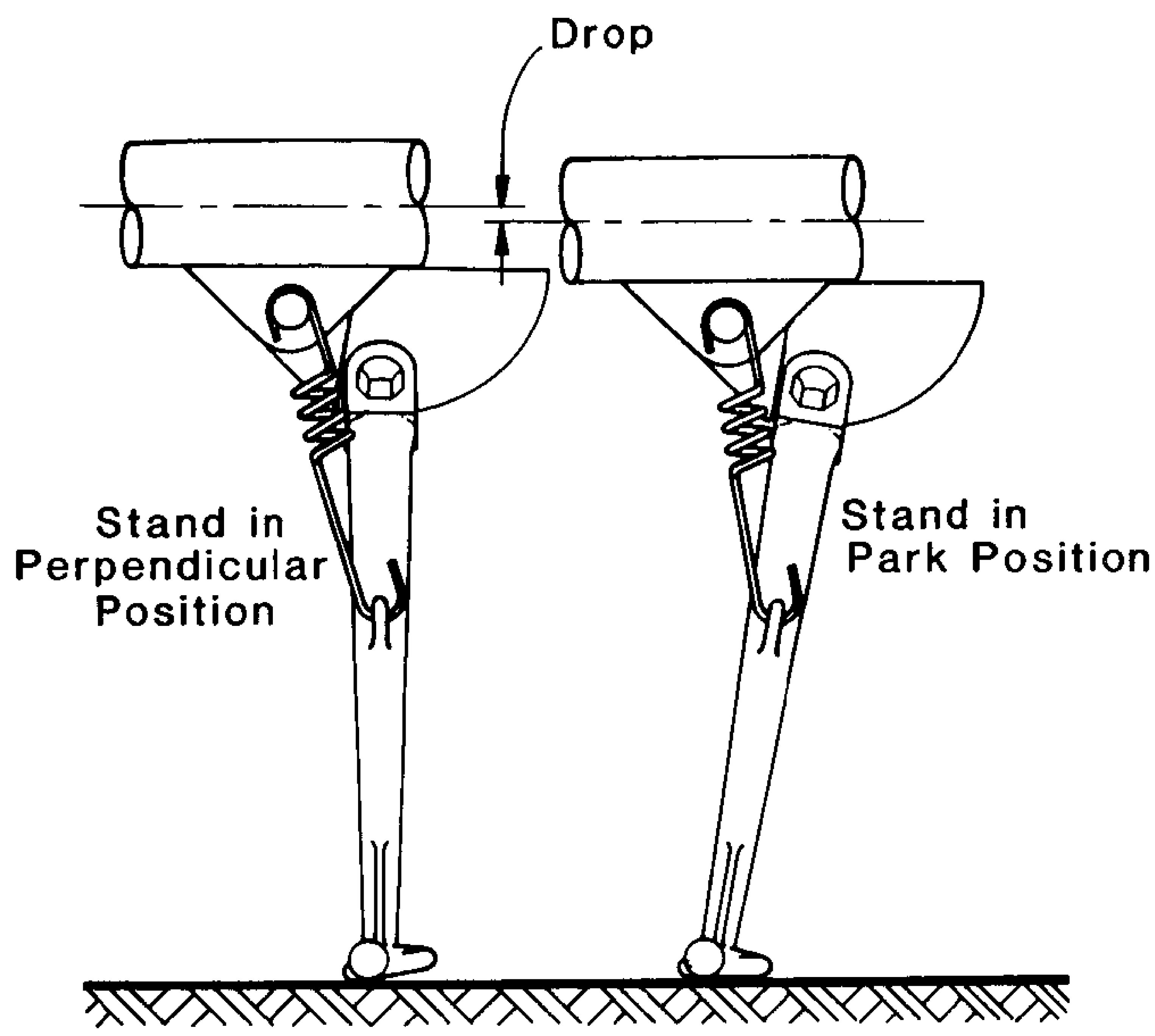


Figure 10: Lifting effect of rotating stand with top mounted spring

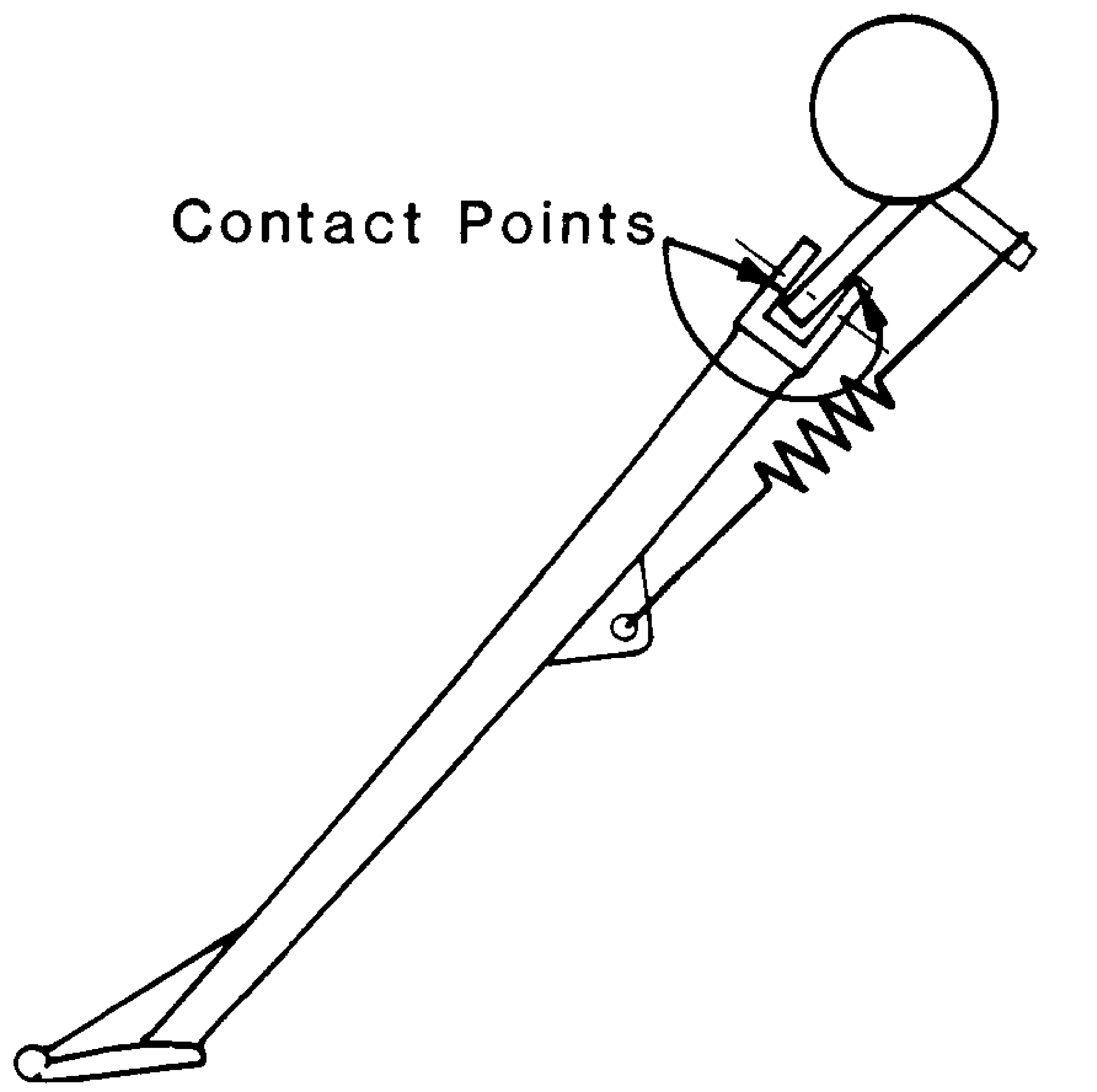


Figure 11: Mount/stand contact with bottom mounted spring

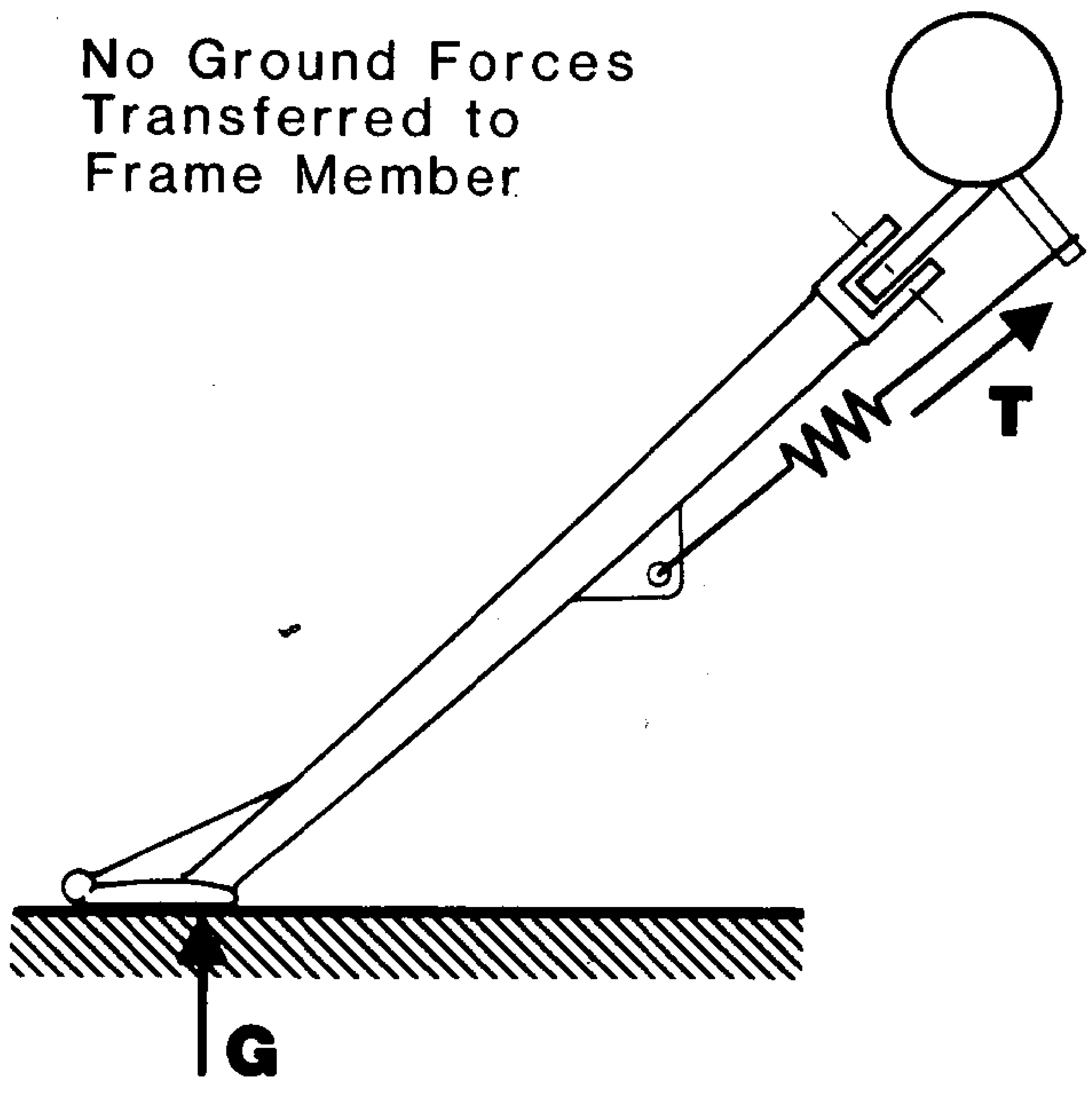


Figure 12: Stand/mount relation while stand is in the floating zone

The mounting bracket friction moment M_B comes into effect only after sufficient motion has taken place and the slack is completely absorbed. If the mount slack is sufficient, and the stand will pass the perpendicular position where the tip is at its lowest before the slack is absorbed, the aforementioned dynamic force and the "jolt" will not come into play.

An effect similar to the floating zone is created by the Honda rubber tip design (Figure 3). Bending the rubber tip following ground contact is equivalent to the stand's upward motion through the floating zone. While ground friction (with the rubber tip) is maintained, no ground forces are transmitted to the motorcycle frame through the stand mount.

Experimental Studies - Experiments were limited to side stand designs that could be left in a parked position while riding the motorcycle and are therefore able to contact the ground from a leaning moving motorcycle. These designs include conventional stands and those using Type II correcting systems. Motorcycles selected included models with top mounted spring (Figure 9), models with bottom mounted spring (Figure 11), Harley Davidson Type II retracting devices (Figure 2) and Honda rubber tipped models (Figure 3). Stands using Type III correcting system were constructed and evaluated also.

Studies of the side stand's behavior were conducted in three phases. During Phase I, several motorcycles were ridden at very low speeds and banked onto the unretracted stands.

During Phase II a conveyor system was set up for laboratory testing of motorcycle stands under controlled conditions (Figure 13). The conveyor consisted of a cloth belt running over a steel plate in a direction opposing a stationary motorcycle. Leaning the motorcycle with its side stand in the parked position into the belt simulated ground friction force directed toward the rear of the motorcycle.

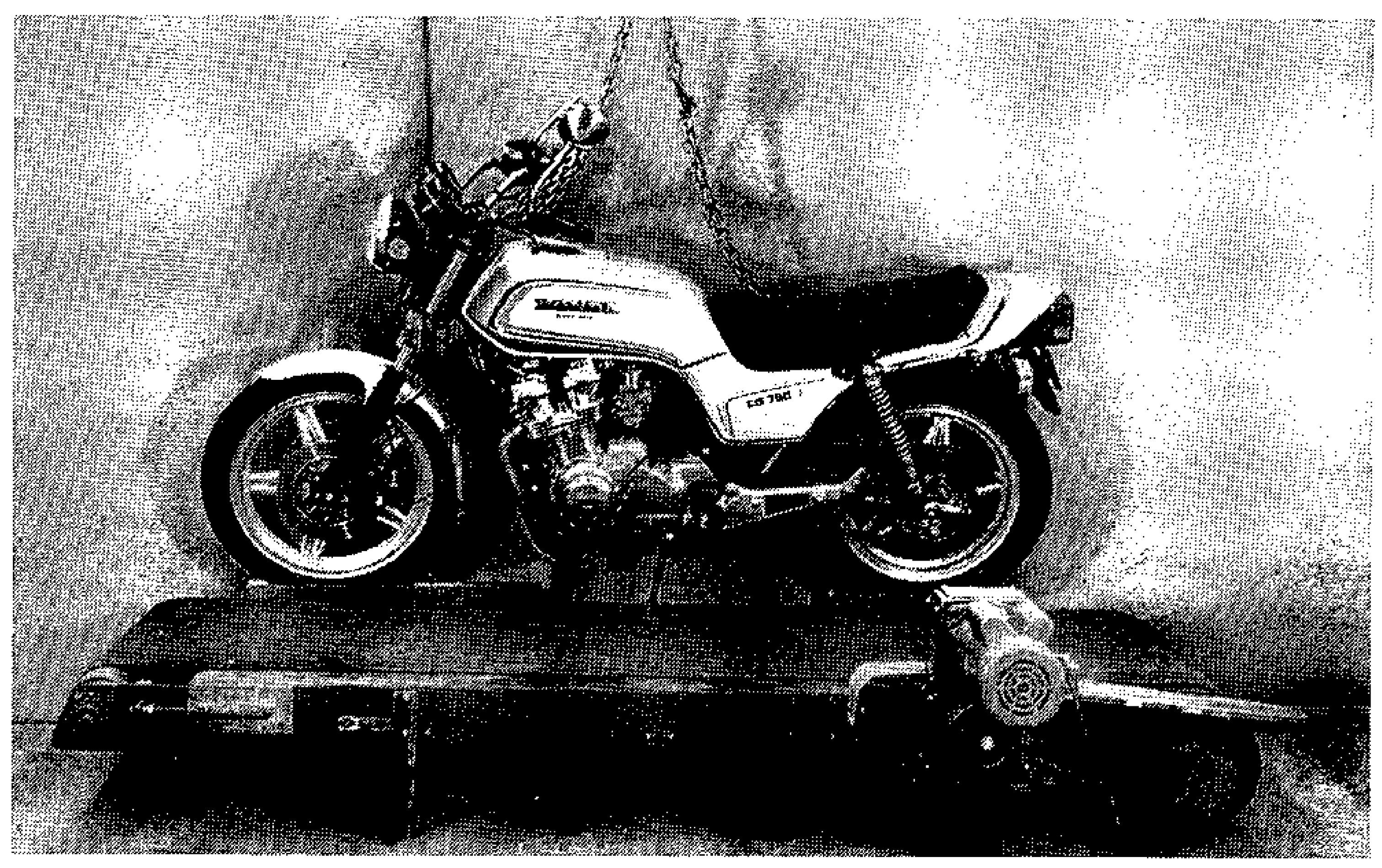


Figure 13: Testing conveyor

The friction coefficient between the belt and a steel sample was 0.5, somewhat higher than the 0.3 to 0.45 found to exist between steel and asphalt or concrete pavement. Maximum conveyor speed used was 15 mph.

Parameters related to the side stand configuration were measured and the numerical values were related to the outcome of the tests. Those found to have significant effect on the retractability of side stands were modified on some test motorcycles and the effects of these changes were evaluated. Parameters considered were:

- Spring location
- mount slack (defined as the stand's angular motion within a vertical plane)
- spring moment (defined by the spring force and the spring offset at parked position)
- forward angle
- conveyor speed

Phase III involved road testing of side stands at speeds in excess of 25 mph.

Most of the testing was done on the conveyor because of the convenience, good repeatability and high degree of consistency with the road tests. Twelve motorcycles containing 32 sets of parameters were used in the tests. Total number of tests performed was in excess of 1600.

TEST FINDINGS

1) The low speed tests performed during Phase I revealed significant differences between stands upon contact with the ground. The differences were noticed by the "feel" of the ground response and varied from no feeling at all to a "jolt" in the motorcycle frame. An attempt to account for these differences was made during the better controlled tests in Phase II
2) Results of the conveyor experiments were repetitive and highly consistent with those of the Phase III road tests.
3) The parameter found to have the greatest effect on the side stand retractability is the spring location. Stands with a bottom mounted spring configuration displayed better retractability than those with a top mounted spring configuration (Table 1)
4) For the bottom mounted spring configuration to allow the stand to retract, three additional conditions were found necessary:
   a) The stand mount slack must exceed a minimum value (Table 2). For the particular motorcycle used to obtain the data shown, 1-1/2° of slack appears to be a transition value for which the retractability is not determined by design factors of the stand. Higher slack angle is needed to achieve retractability in this case.

Table 1 - Effect of Spring Location on Side Stand Retractability

Top Spring			Bottom Spring		
Forward Angle	Spring Moment	Percent Retractability	Forward Angle	Spring Moment	Percent Retractability
10°	9.5 in-lbs	1.8%	10°	9.5 in-lbs	97%
8.6°	17.6 in-lbs	0%	8.7°	24.1 in-lbs	100%
4.8°	34.5 in-lbs	0%	4.8°	34.5 in-lbs	100%

Table 2 - The Mount Slack Effect with a Bottom Mounted Spring

Forward Angle	Spring Moment	Mount Slack	Percent Retractability
8.7°	24.1 in-lbs	0°	0%
8.7°	24.1 in-lbs	1-1/2°	Depends on rate of lean
8.7°	24.1 in-lbs	2°	100%

Table 3 - Effect of Spring Moment and Forward Angle with Bottom Mounted Spring

Forward Angle	Spring Moment	Percent Retractability
10°	9.5 in-lbs	97%
14.7°	15.9 in-lbs	100%
14.7°	22.6 in-lbs	100%
14.7°	30.5 in-lbs	0%
16.5°	15.8 in-lbs	100%
16.5°	21.6 in-lbs	0%
8.7°	24.1 in-lbs	100%
4.8°	34.5 in-lbs	100%

b) The spring moment must not exceed a maximum value (Table 3).

c) The forward angle must be kept low enough (Table 3).

5) The test results in Table 3 demonstrate a relationship between the forward angle and the spring moment. The larger the forward angle, the smaller the spring moment must be to insure stand retractability.

6) The conveyor speed did not appear to have a noticeable effect on the stand's retractability.

7) Road speed variations within the speed range tested did not appear to effect stand retractability.

8) Stands on two motorcycles were changed to Type III retracting types containing a bottom spring, sufficient mount slack and length so that ground contact is maintained if the stand is in the parked position and the motorcycle is set upright. In both cases the stands retracted during the first few inches of motorcycle's forward motion.

9) Lower friction coefficient between the stand shoe and the road surface appear to reduce the stands' retractability. Two stands that had high rectractability in the conveyor tests demonstrated a potential to stay down on some lower friction road surface.

10) The shape and friction characteristics of the stand shoes appeared to have some influence on the retractability. Differences between new and used stands were noted. These effects have not yet been studied in detail.

SUMMARY

1) The potential hazard associated with side stands has been recognized in the motorcycle industry for a long time.

2) Designs attempting to reduce or eliminate the hazard have been applied to production motorcycles.

3) Laboratory and road tests performed demonstrates considerable differences in the retraction characteristics of different side stands. In order for ground friction forces to overcome the system resistance and retract the stand smoothly, the following design parameters were found most helpful:

a) Bottom mounted spring with sufficient mount slack. This guarantees that once the motorcycle is raised from parked position to a riding posture the mount slack is absorbed downward. In this mode, leaning the motorcycle into the stand will result in a transition zone with a floating condition during which the stand shoe maintains ground contact but no reaction forces at the mount exist. The slack should preferably be large enough such that topping at the mount will not occur during the stand rotation from parked to stowed position.

b) The moment created by the spring force and offset toward the parked position must not overcome the moment induced by ground friction forces.

c) A balance between the stand forward angle and the spring moment should be maintained. For a larger forward angle - a lower spring moment can be allowed to maintain retractability.

4) The Honda rubber tip design demonstrates an alternative means to accomplish a transition zone with floating condition. This design uses an additional collapsible member attached to the bottom of the side stand extending lower than its support surface.

5) Side stands designed with Type III correcting systems which maintain ground contact when the motorcycle is set upright were found very effective in retracting immediately upon the beginning of the motorcycle's forward motion.

Two Press Guards . . .

A Second Look

Two press guards have been around a long time. They have been used as illustrations—even recommended. Now, in the true spirit of the volunteer safety movement, a consulting firm has taken a second look at the two guards. They were tested—and found wanting.

THE BASIC strength of the volunteer safety movement was underscored recently when the defects of two popular drill press guards were pointed out by a consulting firm.

The guards, a spring type and a cylindrical enclosure, were depicted in two National Safety Council publications, both the 7th and 8th Editions of the *Accident Prevention Manual for Industrial Operations.*

The company, Triodyne, Inc., Skokie, IL, ran tests on the two "recommended" guards and found some deficiencies.

The **spring type guard** is meant to contain metal slivers and chips that spew forth during a drilling operation. Not only does the guard fail at this purpose, but creates a laceration hazard when ribbons of metallic waste ride up the inside of the guard and spin around over the top.

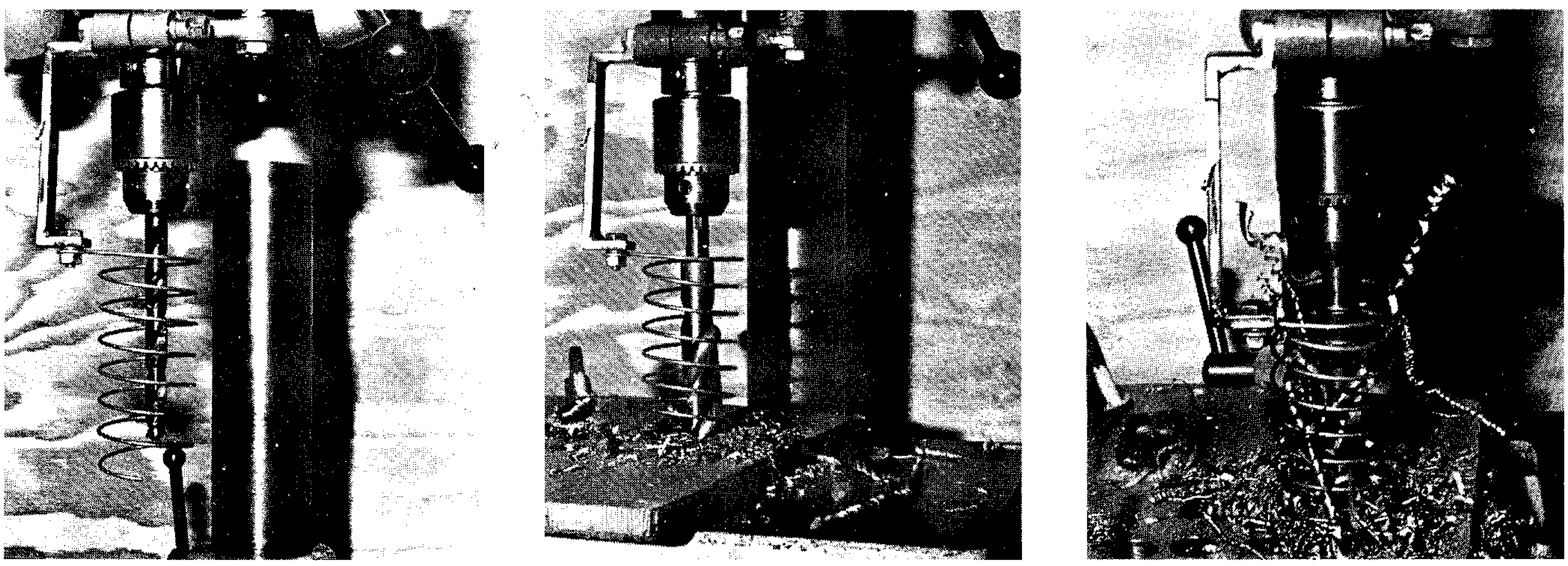
The whipping action of the ribbons can cause cuts when the operator uses the spindle lowering crank. In addition, the spring can become entangled in the rotating drill bit.

The **cylindrical type,** which covers the spindle, chuck, and drill bit, severely limits the function of the press.

The drawbacks noted by Triodyne include:

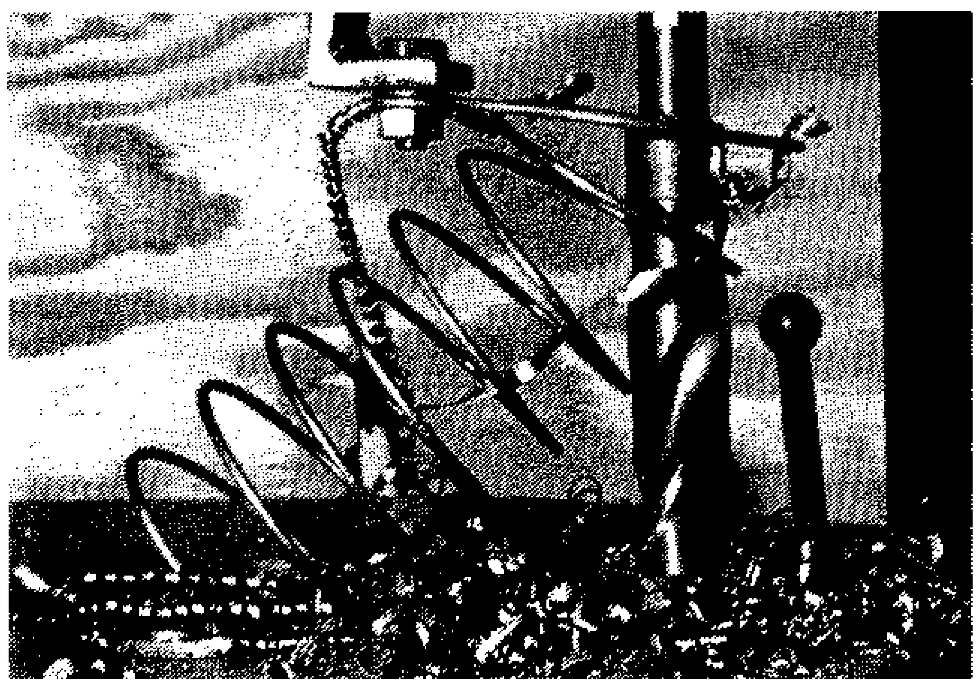
- Presses equipped with depth gages would have the gage completely covered because the guard moves up and down with the spindle;
- The central tube around the drill bit severely limits the maximum stroke of the press when the spindle is stopped by the top of the tube;
- This same feature can damage the guard and the press;
- Metallic chips trapped in the central tube cause premature wear of the bit, excessive heat, severe vibration, and stalling of the press;
- The intent of the cylindrical guard can be defeated because the opening at the bottom is large enough for a hand to reach in;
- Dozens of types of central tubes would have to be provided with the guard because drill bits come in hundreds of combinations of lengths and diameters;
- An operator in a hurry will not necessarily use the proper tube for the bit;
- It is difficult to reach into the guard to operate the chuck and on presses where a wedge and hammer must be used, it is necessary to remove the guard completely.

Spring-Type Guard

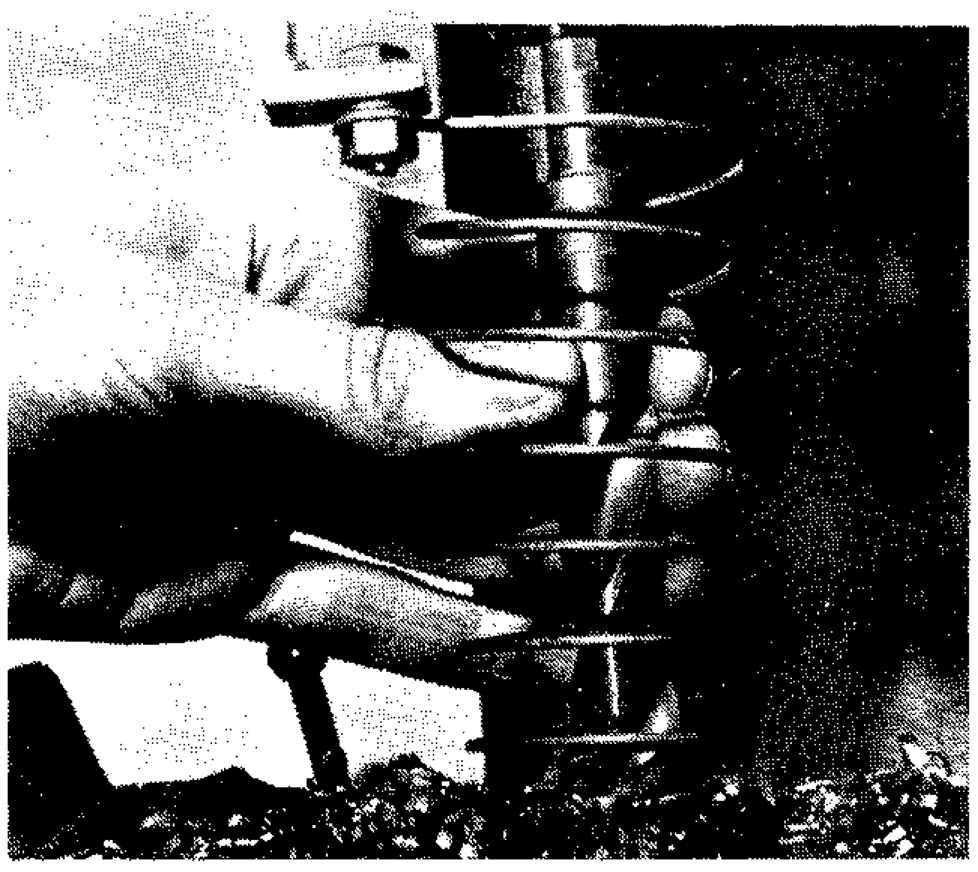


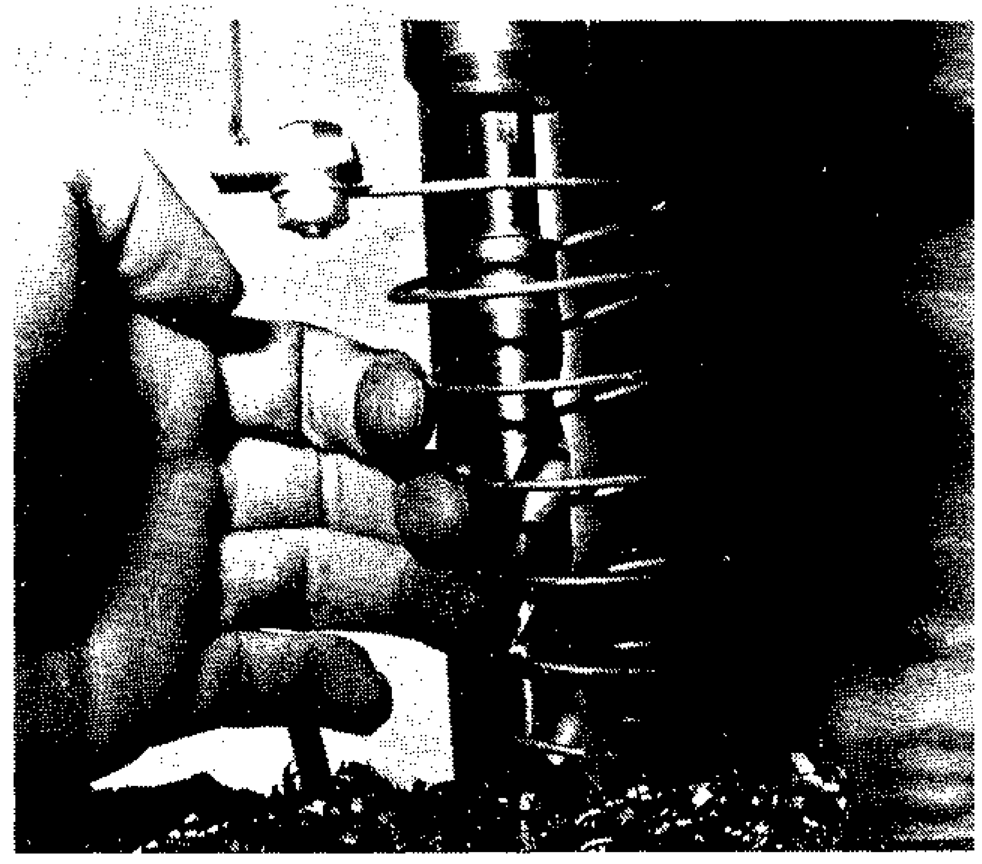
The purpose of this spring guard is to contain the waste metal slivers and chips from the drilling operation. The spindle area is not meant to be covered at all. This sequence of pictures shows how the guard is meant to work.

The waste, in fact, is not contained, but protrudes from the top, causing a lashing, cutting hazard.



The vibration of the press during a drilling operation can cause the spring guard to deflect into the drill bit and become entangled.





The guard does not prevent the operator's fingers from touching the drill bit.

Changing drill bits is a frequent operation. If it is difficult or a nuisance, the operator is likely to leave the guard off the machine completely, according to Triodyne.

The tests were conducted by William G. Switalski, mechanical engineer, and Ralph L. Barnett, professor, mechanical and aerospace engineering.

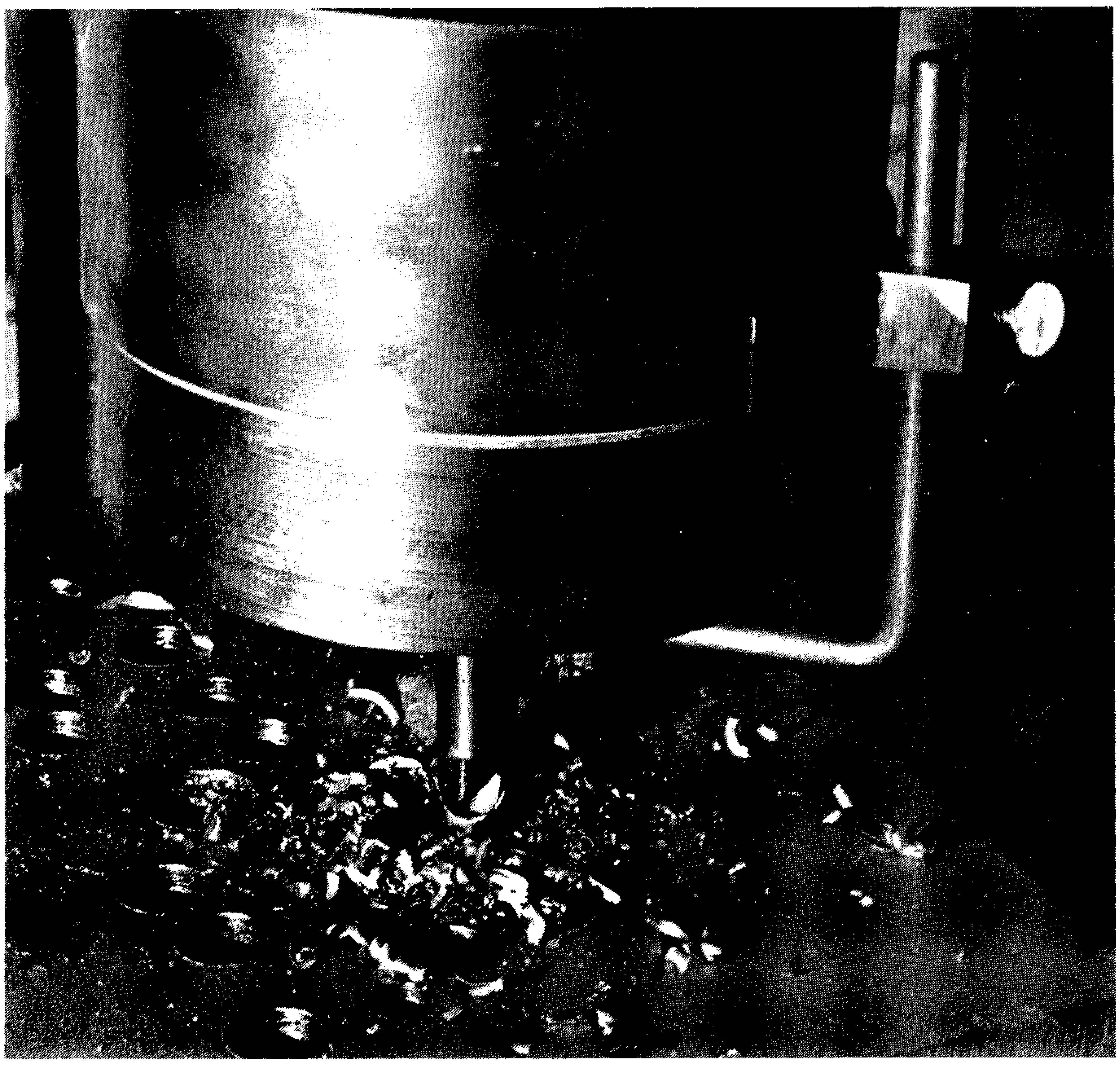
The two made a videotape and still pictures of the tests. Switalski and Barnett provided the National Safety Council with data and information and said, "We will be happy to put you in touch with several of the test engineers . . . if any questions arise concerning our results."

Frank E. McElroy, Council director of technical publications, said, "We kept any recommendations (for use of the guards) out of the latest (4th) Edition of *Guards Illustrated.* Unfortunately, the 8th Edition of the *Accident Prevention Manual (APM)* still recommends the spring-type guard. We will discontinue recommending it in the second printing of this edition."

For more information on an "Errata Sheet" the 8th Edition of the *APM Engineering and Technology,* see the April issue of NSNEWS.

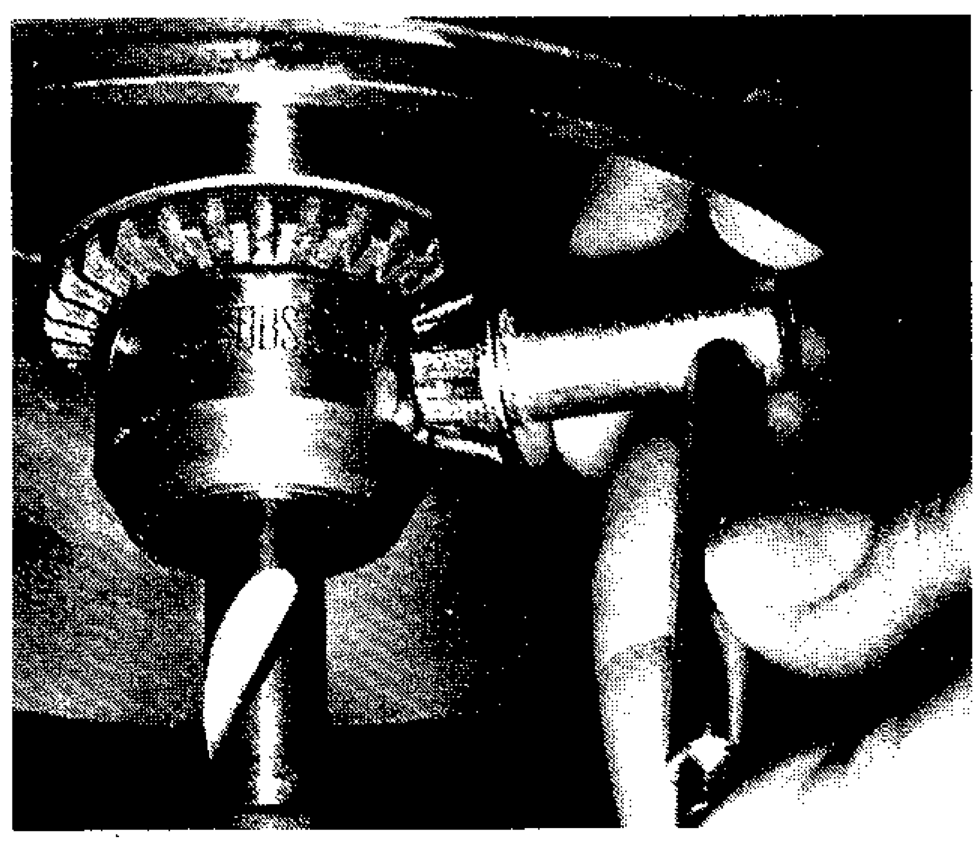
Switalski and Barnett can be reached at Triodyne, 5950 West Touhy Ave., Niles, IL 60648.

Cylindrical-Type Guard



With the cylindrical type, the use of a central tube running the length of the bit has drawbacks. The buildup of scrap metal in the tube causes the bit to wear prematurely, to generate heat, vibrate severely, and the press to stall.

When the spindle hits the top of the central tube, the press is inhibited from using its full stroke.



A closeup shows the difficulty of working the chuck key with the cylindrical enclosure still attached.

SAFETY BRIEF

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