
Tom Swift And His Giant Cannon

Victor Appleton

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Tom Swift And His Giant Cannon

Victor Appleton

Tom Swift And His Giant Cannon
or
The Longest Shots on Record

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CHAPTER I. ON A LIVE WIRE

"Now, see here, Mr. Swift, you may think it all a sort of dream, and imagine that I don't know what I'm talking about; but I do! If you'll consent to finance this expedition to the extent of, say, ten thousand dollars, I'll practically guarantee to give you back five times that sum

"I don't know, Alec, I don't know," slowly responded the aged inventor. "I've heard those stories before, and in my experience nothing ever came of them. Buried treasure, and lost vessels filled with gold, are all well and good, but hunting for an opal mine on some little-heard-of island goes them one better."

"Then you don't feel like backing me up in this matter, Mr. Swift?"

"No, Alec, I can't say I do. Why, just stop and think for a minute. You're asking me to put ten thousand dollars into a company, to fit out an expedition to go to this island—somewhere down near Panama, you say it is—and try to locate the lost mine from which, some centuries ago, opals and other precious stones came. It doesn't seem reasonable."

"But I'm sure I can find the mine, Mr. Swift!" persisted Alec Peterson, who was almost as elderly a man as the one he addressed. "I have the old documents that tell how rich the mine once was, how the old Mexican rulers used to get their opals from it, and how all trace of it was lost in the last century. I have all the landmarks down pat, and I'm sure I can find it. Come on now, take a chance. Put in this ten thousand dollars. I can manage the rest. You'll get back more than five times your investment."

"If you find the mine—yes."

"I tell you I will find it! Come now, Mr. Swift," and the visitor's voice was very pleading, "you and your son Tom have made a fortune for yourselves out of your different inventions. Be generous, and lend me this ten thousand dollars."

Mr. Swift shook his head.

"I've heard you talk the same way before, Alec," he replied. "None of your schemes ever amounted to anything. You've been a fortune-hunter all your life, nearly; and what have you gotten out of it? Just a bare living."

"That's right, Mr. Swift, but I've had bad luck. I did find the lost gold mine I went after some years ago, you remember."

"Yes, only to lose it because the missing heirs turned up, and took it away from you. You could have made more at straight mining in the time you spent on that scheme."

"Yes, I suppose I could; but this is going to be a success—I feel it in my bones."

"That's what you say, every time, Alec. No, I don't believe I want to go into this thing."

"Oh, come—do! For the sake of old times. Don't you recall how you and I used to prospect together out in the gold country; how we shared our failures and successes?"

"Yes, I remember that, Alec. Mighty few successes we had, though, in those days."

"But now you've struck it rich, pardner," went on the pleader. "Help me out in this scheme—do!"

"No, Alec. I'd rather give you three or four thousand dollars for yourself, if you'd settle down to some steady work, instead of chasing all over the country after visionary fortunes. You're getting too old to do that."

"Well, it's a fact I'm no longer young. But I'm afraid I'm too old to settle down. You can't teach an old dog new tricks, pardner. This is my life, and I'll have to live it until I pass out. Well, if you won't, you won't, I suppose. By the way, where is Tom? I'd like to see him before I go back. He's a mighty fine boy."

"That's what he is!" broke in a new voice. "Bless my overshoes, but he is a smart lad! A wonderful lad, that's what! Why, bless my necktie, there isn't anything he can't invent; from a button-hook to a battleship! Wonderful boy—that's what!"

"I guess Tom's ears would burn if he could hear your praises, Mr. Damon," laughed Mr. Swift. "Don't spoil him."

"Spoil Tom Swift? You couldn't do it in a hundred years!" cried Mr. Damon, enthusiastically. "Bless my topknot! Not in a thousand years—no, sir!"

"But where is he?" asked Mr. Peterson, who was evidently unused to the extravagant manner of Mr. Damon.

"There he goes now!" exclaimed the gentleman who frequently blessed himself, some article of his apparel, or some other object. "There he goes now, flying over the house in that Humming Bird airship of his. He said he was going to try out a new magneto he'd invented, and it seems to be working all right. He said he wasn't going to take much of a flight, and I guess he'll soon be back. Look at him! Isn't he a great one, though!"

"He certainly is," agreed Mr. Peterson, as he and Mr. Swift went to the window, from which Mr. Damon had caught a glimpse of the youthful Inventor in his airship. "A great lad. I wish he could come on this mine-hunt with me, though I'd never consent to go in an airship. They're too risky for an old man like me."

"They're as safe as a church when Tom Swift runs them!" declared Mr. Damon. "I'm no boy, but I'd go anywhere with Tom."

"I'm afraid you wouldn't get Tom to go with you, Alec," went on Mr. Swift, as he resumed his chair, the young inventor in his airship having passed out of sight. "He's busy on some new invention now, I believe. I think I heard him say something about a new rifle."

"Cannon it was, Mr. Swift," said Mr. Damon. "Tom has an idea that he can make the biggest cannon in the world; but it's only an idea yet."

"Well, then I guess there's no hope of my interesting him in my opal mine," said the fortune-hunter, with rather a disappointed smile. "Nor you either, Mr. Swift."

"No, Alec, I'm afraid not. As I said, I'd rather give you outright three or four thousand dollars, if you wanted it, provided that you used it for your own personal needs, and promised not to sink it in some visionary search."

Mr. Peterson shook his head.

"I'm not actually in want," he said, "and I couldn't accept a gift of money, Mr. Swift. This is a straight business proposition."

"Not much straight business in hunting for a mine that's been lost for over a century," replied the aged inventor, with a glance at Mr. Damon, who was still at the window, watching for a glimpse of Tom on his return trip in the air craft.

"If Tom would go, I'd trail along," said the odd man. "We haven't done anything worth speaking of since he used his great searchlight to detect the smugglers. But I don't believe he'll go. That mining proposition sounds good."

"It is good!" cried Mr. Peterson, with fervor, hoping he had found a new "prospect" in Mr. Damon.

"But not business-good," declared Mr. Swift, and for some time the three argued the matter, Mr. Swift continuing to shake his head.

Suddenly into the room there ran an aged colored man, much excited.

"Fo' de land sakes!" he cried. "Somebody oughter go out an' help Massa Tom!"

"Why, what's the matter, Eradicate?" asked Mr. Swift, leaping to his feet, an example followed by the other two men. "What has happened to my son?"

"I dunno, Massa Swift, but I looked up jest now, an' dere he be, in dat air-contraption ob his'n he calls de Hummin' Burd. He's ketched up fast on de balloon shed roof, an' dere he's hangin' wif sparks an' flames a-shootin' outer de airship suffin' scandalous! It's jest spittin' fire, dat's what it's a-doin', an' ef somebody don't do suffin' fo' Massa Tom mighty quick, dere ain't gwin t' be any Massa Tom; now dat's what I'se aÄtellin' you!"

"Bless my shoe buttons!" gasped Mr. Damon. "Come on out, everybody! We've got to help Tom!"

"Yes!" assented Mr. Swift. "Call someone on the telephone! Get a doctor! Maybe he's shocked! Where's Koku, the giant? Maybe he can help!"

"Now doan't yo' go t' gittin' all excited-laik," objected Eradicate Sampson, the aged colored man. "Remember yo' all has got a weak heart, Massa Swift!"

"I know it; but I must save my son. Hurry!"

Mr. Swift ran from the room, followed by Mr. Damon and Mr. Peterson, while Eradicate trailed after them as fast as his tottering limbs would carry him, murmuring to himself.

"There he is!" cried Mr. Damon, as he caught sight of the young inventor in his airship, in a position of peril. Truly it was as Eradicate had said. Caught on the slope of the roof of his big balloon shed, Tom Swift was in great danger.

From his airship there shot dazzling sparks, and streamers of green and violet fire. There was a snapping, cracking sound that could be heard above the whirl of the craft's propellers, for the motor was still running.

"Oh, Tom! Tom! What is it? What has happened?" cried his father.

"Keep back! Don't come too close!" yelled the young inventor, as he clung to the seat of the aeroplane, that was tilted at a dangerous angle. "Keep away!"

"What's the matter?" demanded Mr. Damon. "Bless my pocket comb --what is it?"

"A live wire!" answered Tom. "I'm caught in a live wire! The trailer attached to the wireless outfit on my airship is crossed with the wire from the power plant. There's a short circuit somewhere. Don't come too close, for it may burn through any second and drop down. Then it will twist about like a snake!"

"Land ob massy!" cried Eradicate.

"What can we do to help you?" called Mr. Swift. "Shall I run and shut off the power?" for in the shop where Tom did most of his inventive work there was a powerful dynamo, and it was on one of the wires extending from it, that brought current into the house, that the craft had caught.

"Yes, shut it off if you can!" Tom shouted back. "But be careful. Don't get shocked! Wow! I got a touch of it myself that time!" and he could be seen to writhe in his seat.

"Oh, hurry! hurry! Find Koku!" cried Mr. Swift to Mr. Damon, who had started for the power house on the run.

The sparks and lances of fire seemed to increase around the young inventor. The airship could be seen to slip slowly down the sloping roof.

"Land ob massy! He am suah gwine t' fall!" yelled Eradicate.

"Oh, he'll never get that current shut off in time!" murmured Mr. Swift, as he started after Mr. Damon.

"Wait! I think I have a plan!" called Mr. Peterson. "I think I can save Tom!"

He did not waste further time in talk, but, running to a nearby shed, he got a long ladder that he saw standing under it. With this over his shoulder he retraced his steps to the balloon hangar and placed the ladder against the side. Then he started to climb up.

"What are you going to do?" yelled Tom, leaning over from his seat to watch the elderly fortune-hunter.

"I'm going to cut that wire!" was the answer.

"Don't! If you touch it you'll be shocked to death! I may be able to get out of here. So far I've only had light shocks, but the insulation is burning out of my magneto, and that will soon stop. When it does I can't run the motor, and—"

"I'm going to cut that wire!" again shouted Mr. Peterson.

"But you can't, without pliers and rubber gloves!" yelled Tom. "Keep away, I tell you!"

The man on the ladder hesitated. Evidently he had not thought of the necessity of protecting his hands by rubber covering, in order that the electricity might be made harmless. He backed down to the ground.

"I saw a pair of old gloves in the shed!" he cried. "I'll get them—they look like rubber."

"They are!" cried Tom, remembering now that he had been putting up a new wire that day, and had left his rubber gloves there. "But you haven't any pliers!" the lad went. "How can you cut wire without them? There's a pair in the shop, but—"

"Heah dey be! Heah dey be!" cried Eradicate, as he produced a heavy pair from his pocket. "I—I couldn't find de can-opener fo' Mrs. Baggert, an' I jest got yo' pliers, Massa Tom. Oh, how glad I is dat I did. Here's de pincers, Massa Peterson."

He handed them to the fortune-hunter, who came running back with the rubber gloves. Mr. Damon was no more than half way to the power house, which was quite a distance from the Swift homestead. Meanwhile Tom's airship was slipping more and more, and a thick, pungent smoke now surrounded it, coming from the burning insulation. The sparks and electrical flames were worse than ever.

"Just a moment now, and I'll have you safe!" cried the fortune-hunter, as he again mounted the ladder. Luckily the charged wire was near enough to be reached by going nearly to the top of the ladder.

Holding the pincers in his rubber-gloved hands, the old man quickly snipped the wire. There was a flash of sparks as the copper conductor was severed, and then the shower of sparks about Tom's airship ceased.

In another second he had turned on full power, the propellers whizzed with the quickness of light, and he rose in the air, off the shed roof, the live wire no longer entangling him. Then he made a short circuit of the work-shop yard, and came to the ground safely a little distance from the balloon hangar.

"Saved! Tom is saved!" cried Mr. Swift, who had seen the act of Mr. Peterson from a distance. "He saved my boy's life!"

"Thanks, Mr. Peterson!" exclaimed the young inventor, as he left his seat and walked up to the fortune-hunter. "You certainly did me a good turn then. It was touch and go! I couldn't have stayed there many seconds longer. Next time I'll know better than to fly with a wireless trailer over a live conductor," and he held out his hand to Mr. Peterson.

"I'm glad I could help you, Tom," spoke the other, warmly. "I was afraid that if you had to wait until they shut off the power it would be too late."

"It would—it would—er—I feel—I—"

Tom's voice trailed off into a whisper and he swayed on his feet.

"Cotch him!" cried Eradicate. "Cotch him! Massa Tom's hurt!" and only just in time did Mr. Peterson clutch the young inventor in his arms. For Tom, white of face, had fallen back in a dead faint.

CHAPTER II. "WE'LL TAKE A CHANCE!"

"Carry him into the house!" cried Mr. Swift, as he came running to where Mr. Peterson was loosening Tom's collar.

"Git a doctor!" murmured Eradicate. "Call someone on de tellifoam! Git fo' doctors!"

"We must get him into the house first," declared Mr. Damon, who, seeing that Tom was off the shed roof, had stopped mid-way to the powerhouse, and retraced his steps. "Let's carry him into the house. Bless my pocketbook! but he must have been shocked worse than he thought."

They lifted the inert form of our hero and walked toward the mansion with him, Mrs. Baggert, the housekeeper, standing in the doorway in dismay, uncertain what to do.

And while Tom is being cared for I will take just a moment to tell my new readers something more about him and his inventions, as they have been related in the previous books of this series.

The first volume was called "Tom Swift and His Motor-Cycle," and this machine was the means of his becoming acquainted with Mr. Wakefield Damon, the odd gentleman who so often blessed things. On his motor-cycle Tom had many adventures.

The lad was of an inventive mind, as was his father, and in the succeeding books of the series, which you will find named in detail elsewhere, I related how Tom got a motorboat, made an airship, and later a submarine, in all of which craft he had strenuous times and adventures.

His electric runabout was quite the fastest car on the road, and when he sent his wonderful wireless message he saved himself and others from Earthquake Island. He solved the secret of the diamond makers, and, though he lost a fine balloon in the caves of ice, he soon had another air craft—a regular sky-racer. His electric rifle saved a party from the red pygmies in Elephant Land, and in his air glider he found the platinum treasure. With his wizard camera, Tom took wonderful moving pictures, and in the volume immediately preceding this present one, called "Tom Swift and His Great Searchlight," I had the pleasure of telling you how the lad captured the smugglers who were working against Uncle Sam over the border.

Tom, as you will see, had, with the help of his father, perfected many wonderful inventions. The lad lived with his aged parent, his mother being dead, in the village of Shopton, in New York State.

While the house, which was presided over by the motherly Mrs. Baggert, was large, it was almost lost now amid the many buildings surrounding it, from balloon and airship hangars, to shops where varied work was carried on. For Tom did most of his labor himself, of course with men to help him at the heavier tasks. Occasionally he had to call on outside shops.

In the household, beside his father, himself and Mrs. Baggert, was Eradicate Sampson, an aged colored man-of-all-work, who said he was called "Eradicate" because he eradicated dirt. There was also Koku, a veritable giant, one of two brothers whom Tom had brought with him from Giant Land, when he escaped from captivity there, as related in the book of that name.

Mr. Damon was, with Ned Newton, Tom's chum, the warmest friend of the family, and was often at Tom's home, coming from the neighboring town of Waterford, where he lived.

Tom had been back some time now from working for the government in detecting the smugglers, but, as you may well suppose, he had not been idle. Inventing a number of small things, including useful articles for the house, was a sort of recreation for him, but his mind was busy on one great scheme, which I will tell you about in due time.

Among other things he had just perfected a new style of magneto for one of his airships. The magneto, as you know, is a sort of small dynamo, that supplies the necessary spark to the cylinder, to explode the mixture of air and gasoline vapor. He was trying out this magneto in the Humming Bird when the accident I have related in the first chapter occurred.

"There! He's coming to!" exclaimed Mrs. Baggert, as she leaned over Tom, who was stretched out on the sofa in the library. "Give him another smell of this ammonia," she went on, handing the bottle to Mr. Swift.

"No—no," faintly murmured Tom, opening his eyes. "I—I've had enough of that, if you please! I'm all right."

"Are you sure, Tom?" asked his father. "Aren't you hurt anywhere?"

"Not a bit, Dad! It was foolish of me to go off that way; but I couldn't seem to help it. It all got black in front of me, and— well, I just keeled over."

"I should say you did," spoke Mr. Peterson.

"An' ef he hadn't a-been there to cotch yo' all," put in Eradicate, "yo' all suah would hab hit de ground mighty hard."

"That's two services he did for me today," said Tom, as he managed to sit up. "Cutting that wire—well, it saved my life, that's certain."

"I believe you, Tom," said Mr. Swift, solemnly, and he held out his hand to his old mining partner.

"Do you need the doctor?" asked Mr. Damon, who was at the telephone. "He says he'll come right over—I can get him in Tom's electric runabout, if you say so. He's on the wire now."

"No, I don't need him," replied the young inventor. "Thank him just the same. It was only an ordinary faint, caused by the slight electrical shocks, and by getting a bit nervous, I guess. I'm all right—see," and he proved it by standing up.

"He's ail right—don't come, doctor," said Mr. Damon into the telephone. "Bless my keyring!" he exclaimed, "but that was a strenuous time!"

"I've been in some tight places before," went on Tom, as he sat down in an easy chair, "and I've had any number of shocks when I've been experimenting, but this was a sort of double combination, and it sure had me guessing. But I'm feeling better every minute."

"A cup of hot tea will do you good," said motherly Mrs. Baggert, as she bustled out of the room. "I'll make it for you."

"You cut that wire as neatly as any lineman could," went on Tom, glancing from Mr. Peterson out of the window to where one of his workmen was repairing the break. "When I flew over it in my airship I never gave a thought to the trailer from my wireless outfit. The first I knew I was caught back, and then pulled down to the balloon shed roof, for I tilted the deflecting rudder by mistake."

"But, Mr. Peterson," Tom went on, "I haven't seen you in some time. Anything new on, that brings you here?" for the fortune-hunter had called at the Swift house after Tom had gone out to the shop to get his airship ready for the flight to try the magneto.

"Well, Tom, I have something rather new on," replied Mr. Peterson. "I hoped to interest your father in it, but he doesn't seem to care to take a chance. It's a lost opal mine on a little-known island in the Caribbean Sea not far from the city of Colon. I say not far—by that I mean about twenty miles. But your father doesn't want to invest, say, ten thousand dollars in it, though I can almost guarantee that he'll get five times that sum back. So, as long as he doesn't feel that he can help me out, I guess I'd better be traveling on."

"Hold on! Wait a minute. Don't be in a hurry," said Mr. Swift.

Mr. Peterson was an old friend, and when he and Mr. Swift were young men they had prospected and grub-staked together. But Mr. Swift soon gave that up to devote his time to his inventions, while Mr. Peterson became a sort of rolling stone.

He was a good man, but somewhat visionary, and a bit inclined to "take chances"—such as looking for lost treasure—rather than to devote himself to some steady employment. The result was that he led rather a precarious life, though never being actually in want.

"No, pardner," he said to Mr. Swift. "It's kind of you to ask me to stay; but this mine business has got a grip on me. I want to try it out. If you won't finance the project someone else may. I'll say good-bye, and—"

"Now just a minute," said Mr. Swift. "It's true, Alec, I had about made up my mind not to go into this thing, when this accident happened to Tom. Now you practically saved his life. You—"

"Oh, pshaw! I only acted on the spur of the moment. Anyone could have done what I did," protested the fortune-hunter.

"Oh, but you did it!" insisted Mr. Swift, "and you did it in the nick of time. Now I wouldn't for a moment think of offering you a reward for saving my son's life. But I do feel mighty friendly toward you—not that I didn't before—but I do want to help you. Alec, I will go into this business with you. We'll take a chance! I'll invest ten thousand dollars, and I'm not so awful worried about getting it back, either—though I don't believe in throwing money away."

"You won't throw it away in this case!" declared Mr. Peterson, eagerly. "I'm sure to find that mine; but it will take a little capital to work it. That's what I need—capital!"

"Well, I'll supply it to the extent of ten thousand dollars," said Mr. Swift. "Tom, what do you think of it? Am I foolish or not?"

"Not a bit of it, Dad!" cried the young man, who was now himself again. "I'm glad you took that chance, for, if you hadn't—well, I would have supplied the money myself—that's all," and he smiled at the fortune-hunter.

CHAPTER III. PLANNING A BIG GUN

"BUT, Tom, I don't see how in the world you can ever hope to make a bigger gun than that."

"I think it can be done, Ned," was the quiet answer of the young inventor. He looked up from some drawings on the table in the office of one of his shops. "Now I'll just show you—"

"Hold on, Tom. You know I have a very poor head for figures, even if I do help you out once in a while on some of your work. Skip the technical details, and give me the main facts."

The two young men—Ned Newton being Tom's special chum—were talking together over Tom's latest scheme.

It was several days after Tom's accident in the airship, when he had been saved by the prompt action of Mr. Peterson. That fortune-hunter, once he had the promise of Mr. Swift to invest in his somewhat visionary plan of locating a lost opal mine near the Panama Canal, had left the Swift homestead to arrange for fitting out the expedition of discovery. He had tried to prevail on Tom to accompany him, and, failing in that, tried to work on Mr. Damon.

"Bless my watch chain!" exclaimed that odd gentleman. "I would like to go with you first rate. But I'm so busy—so very busy—that I can't think of it. I have simply neglected all my affairs, chasing around the country with Tom Swift. But if Tom goes I—ahem! I think perhaps I could manage it—ahem!"

"I thought you were busy," laughed Tom.

"Oh, well, perhaps I could get a few weeks off. But I'm not going—no, bless my check book, I must get back to business!"

But as Mr. Damon was a retired gentleman of wealth, his "business" was more or less of a joke among his friends.

So then, a few days after the departure of Mr. Peterson, Tom and Ned sat in the former's office, discussing the young inventor's latest scheme.

"How big is the biggest gun ever made, Tom?" asked his chum. "I mean in feet, in inches, or in muzzle diameter, however they are measured."

"Well," began Tom, "of course some nation may, in secret, be making a bigger gun than any I have ever heard of. As far as I know, however, the largest one ever made for the United States was a sixteen-inch rifled cannon—that is, it was sixteen inches across at the muzzle, and I forget just how long. It weighed many tons, however, and it now lies, or did a few years ago, in a ditch at the Sandy Hook proving grounds. It was a failure."

"And yet you are figuring on making a cannon with a muzzle thirty inches across—almost a yard—and fifty feet long and to weigh—"

"No one can tell exactly how much it will weigh," interrupted Tom. "And I'm not altogether certain about the muzzle measurement, nor of the length. It's sort of in the air at present. Only I don't see why a larger gun than any that has yet been made, can't be constructed."

"If anybody can invent one, you can, Tom Swift!" exclaimed Ned, admiringly.

"You flatter me!" exclaimed his chum, with a mock bow.

"But what good will it be?" went on Ned. "Making big guns doesn't help any in war, that I can see."

"Ned!" exclaimed Tom, "you don't look far enough ahead. Now here's my scheme in a nutshell. You know what Uncle Sam is doing down in his big ditch; don't you?"

"You mean digging the Panama Canal?"

Yes, the greatest engineering feat of centuries. It is going to make a big change in the whole world, and the United States is going to become—if she is not already—a world-power. Now that canal has to be protected—I mean against the possibility of war. For, though it may never come, and the chances are it never will, still it may.

"Uncle Sam has to be ready for it. There never was a more true saying than 'in time of peace prepare for war.' Preparing for war is, in my opinion, the best way not to have one.

"Once the Panama Canal is in operation, and the world—changes incidental to it have been made, if it should pass into the hands of some foreign country—as it very possibly might do—the United States would not only be the laughing-stock of the world, but she would lose the high place she holds.

"Now, then, to protect the canal, several things are necessary. Among them are big guns—cannon that can shoot a long distance—for if a foreign nation should send some of their new dreadnaughts over here—vessels with guns that can shoot many miles—where would the canal be once a bombardment was opened? It would be ruined in a day—the immense lock-gates would be destroyed. And, not only from the guns aboard ships would there be danger, but from siege cannon planted in Costa Rica, or some South American country below the canal zone.

"Now, to protect the canal against such an attack we need guns that can shoot farther, straighter and more powerfully than any at present in use, and we've got to have the most powerful explosive. In other words, we've got to beat the biggest guns that are now in existence. And I'm going to do it, Ned!"

"You are?"

"Yes, I'm going to invent a cannon that will make the longest shots on record. I'm going to make a world-beater gun; or, rather, I'm going to invent it, and have it made, for I guess it would tax this place to the limit.

"I've been thinking of this for some time, Ned. I've been puttering around inventing new magnetos, potato-parers and the like, but this is my latest hobby. The Panama Canal is a big thing—one of the biggest things in the world. We need the biggest guns in the world to protect it.

"And, listen: Uncle Sam thinks the same way. I understand that the best men in the service—at West Point, Annapolis and Sandy Hook, as well as elsewhere—are working in the interest of the United States to perfect a bigger cannon than any ever before made. In fact, one has just been constructed, and is going to be tried at the Sandy Hook proving grounds soon. I'm going to see the test if I can.

"And here's another thing. Foreign nations are trying to steal Uncle Sam's secrets. If this country gets a big cannon, some other nation will want a bigger one. It's a constant warfare. I'm going to devote my talents—such as they are—to Uncle Sam. I'm going to make the biggest cannon in the world—the one that will shoot the farthest and knock into smithereens all the other big guns. That's the only way to protect the canal. Do you understand, Ned?"

"Somewhat, Tom. Since I gave up my place in the bank, and became a sort of handy-lad for you, I know more about your work. But isn't it going to be dangerous to make a cannon like that?"

"Well, in a way, yes, Ned. But we've got to take chances, just as father did when he invested ten thousand dollars in that opal mine. He'll never see his money again."

"Don't you think so?"

"No, Ned."

"And when do you expect to start on your gun, Tom?"

"Right away. I'm making some plans now. I'm going down to Sandy Hook and witness the test of this new big cannon. You can come along, if you like."

"Well, I sure will like. When is it?"

"Oh, in about a week. I'll have to look—"

"Scuse me, Massa Tom," broke in Eradicate, as he put his head through the half-opened office door. "Scuse me, but dere's a express gen'men outside, wif his auto truck, an' he's got some packages fo' yo' all, marked 'dangerous—explosive—an' keep away fom de fire.' He want t' know what he all gwine t' do wif 'em, Massa Tom?"

"Do with 'em? Oh, I guess it's that new giant powder I sent for. Why, Eradicate, have him bring 'em right in here."

"Yais, sah, Massa Tom. Dat's all right; but he jest can't bring 'em in," and Eradicate looked behind him somewhat apprehensively.

"Can't bring 'em in? Why not, I'd like to know?" exclaimed Tom. "He's paid for it."

"Scuse me, Massa Tom," said the colored man, "but dat express gen'men can't bring dem explosive powder boxes in heah, 'case as how his autermobile hab done ketched fire an' he cain't get near it nohow. Dat's why, Massa Tom!"

"Caesar's ghost!" yelled the young inventor. "The auto on fire, and that powder in it! Come on Ned!" and he made a rush for the door.

CHAPTER IV. KOKU'S BRAVE ACT

"Tom! Tom!" cried Ned, as he watched the disappearing figure of his chum. "Come back here! If there's going to be an explosion we ought to run out of the back door!"

"I'm not running away!" flashed back Tom. "I'm going to get that powder out of the auto before it goes up! If it does we'll be blown to kingdom come, back door or front door! Come on!"

"Bacon and eggs!" yelled Ned. "He's running an awful risk! But I can't let him go alone! I guess we're in for it!"

Then he, too, rushed from the office toward the front of the shop, before which, in a sort of private road, stood the blazing auto. And Ned, who had now lost sight of Tom, because of our hero having turned a corner in the corridor, heard excited shouts coming from the seat of trouble.

"If that's some new kind of powder Tom's sent for, to test for his new big gun, and it goes up," Ned said to himself, as he rushed on, "this place will be blown to smithereens. All Tom's valuable machinery and patents will be ruined!"

Ned had now reached the front door of the shop. He had a glimpse of the burning auto—a small express truck, well loaded with various packages. And, through the smoke, which from the odor must have been caused by burning gasoline, Ned could see several boxes marked in red letters:

DANGEROUS EXPLOSIVE

KEEP AWAY FROM FIRE

"Keep away from fire!" murmured the panting lad. "If they can get any nearer fire I don't see how."

"Oh, mah golly!" gasped Eradicate, who had lumbered on behind Ned. "Oh, mah golly! Oh, good land ob massy! Look at Massa Tom!"

"I've got to help him!" cried Ned, for he saw that his chum had rushed to the rear of the auto, and was endeavoring to drag one of the powder boxes across the lowered tail-board. Tom was straining and tugging at it, but did not seem able to move the case. It was heavy, as Ned learned later, and was also held down by the weight of other express packages on top of it.

"Oh, mah golly!" cried Eradicate. "Git some watah, somebody, an' put out dat fire!"

"No—no water!" yelled Tom, who heard him. "Water will only make it worse—it'll scatter the blazing gasoline. The feed pipe from the tank must have burst. Throw on sand—sand is the only thing to use!"

"I'll git a shubble!" cried Eradicate. "I'll git a sand- shubble!" and he tottered off.

"Wait, Tom, I'll give you a hand!" cried Ned, as he saw his chum step away from the end of the auto for a moment, as a burst of flame, and choking smoke, driven by the wind, was blown almost in his face. "I'll help you!"

"We've got to be lively, then, Ned!" gasped Tom. "This is getting hotter every minute! Where's that Koku? He could yank these boxes out in a jiffy!"

And indeed a giant's strength was needed at that moment.

Ned glanced around to see if he could catch a glimpse of the big man whom Tom had brought from Giant Land, but Koku was not in sight.

"Let's have another try now, Ned!" suggested Tom, when a shift in the wind left the rear of the auto comparatively free from smoke and flame.

"You fellows had better skip!" cried the expressman, who had been throwing light packages off his vehicle from in front, where, as yet, there was no fire. "That powder'll go up in another minute. Some of the boxes are beginning to catch now!" he yelled. "Look out!"

"That's right!" shouted Tom, as he saw that the edge of one of the wooden cases containing the powder was blazing slightly. "Lively, Ned!"

Ned held back only for a second. Then, realizing that the time to act was now or never, and that even if he ran he could hardly save himself, he advanced to Tom's side. The smoke was choking and stifling them, and the flames, coming from beneath the auto truck, made them gasp for breath.

Together Tom and Ned tugged at the nearest case of powder—the one that was ablaze.

"We—we can't budge it!" panted Tom.

"It—it's caught somewhere," added Ned. "Oh, if Koku were only here!"

There was a sound behind the lads. A voice exclaimed:

"Master want shovel, so Eradicate say—here it is!"

They turned and saw a big, powerful man, with a simple, child- like face, standing calmly looking at the burning auto.

"Koku!" cried Tom. "Quick! Never mind the shovel! Get those powder boxes out of that cart before they go up! Yank 'em out! They're too much for Ned and me! Quick!"

"Oh, of a courseness I will so do!" said Koku, to whom, even yet, the English language was somewhat of a mystery. He dropped the shovel, and, heedless of the thick smoke from the burning gasoline, reached over and took hold of the nearest box. It seemed as though he pulled it from the auto truck as easily as Tom might have lifted a cork.

Then, carrying the box, which was now burning quite fiercely on one corner, over toward Tom and Ned, who had moved back, the giant asked:

"What you want of him, Master?"

"Put it down, Koku, and get out all the others! Lively, now, Koku!"

"I do," was the simple answer. The giant put the box on the grass and ran back toward the auto.

"Quick, Ned!" shouted Tom. "Throw some sand on this burning box! That will put out the fire!"

A few handfuls of earth served to extinguish the little blaze, and by this time Koku had come back with another box of powder.

"Get 'em all, Koku, get 'em all! Then we can put out the fire on the auto."

For the giant it was but child's play to carry the heavy boxes of powder, and soon he had them all removed from the truck. Then, with the danger thus narrowly averted, they all, including the expressman, turned in and began throwing sand on the fire, which now had a good hold on the body of the auto. The shovel, which Eradicate had sent by Koku, who could use more speed than could the aged colored man, came in handy.

Soon the fire was out, though not before the truck had been badly damaged, and some of its load destroyed. But, beyond a charring of some of the powder boxes, the explosive was intact.

"Whew! That was a lucky escape," murmured Tom, as he sat down on one of the boxes, and wiped the smoke and sweat from his face. "A little later and there'd only been a hole in the ground to tell what happened. hot work; eh, Ned?"

"I guess yes, Tom."

"I thought of the powder as soon as I saw that the truck was on fire," explained the expressman; "but I didn't know what to do. I was kinder flustered, I guess. This is the second time this old truck has caught fire from a leaky gasoline pipe. I guess that will be the last—it will for me, anyhow. I'll resign if they don't give me another machine. Will you sign for your stuff?" he asked Tom, holding out the receipt book, which had escaped the flames.

"Yes, and I'm mighty glad I'm here to sign for it," replied the young inventor. "Now, Koku, I guess you can take that stuff up to the shop; but be careful where you put it."

"I do, Master," replied the giant.

"What sort of powder is that, Tom?" asked Ned a little later, when they were again back in the office, the excitement having calmed down. The expressman had gone back to town afoot, to arrange about getting another vehicle for what remained of his load. "Is it the kind they use in big guns?"

"One of the kinds," replied Tom. "I sent for several samples, and this is one. I'm going to conduct some tests to see what kind I'll need for my own big gun. But I expect I'll have to invent an explosive as well as a cannon, for I want the most powerful I can get. Want to look at some of this powder?"

"Yes, if you think it's safe."

"Oh, it's safe enough if you treat it right. I'll show you," and working carefully Tom soon had one of the boxes open. Reaching into the depths he held up a handful of something that looked like sticks of macaroni. "There it is," he said.

"That powder?" cried Ned. "That's a queer kind. I've seen the kind they use in some guns on the battleships. That powder was in hexagonal form, about two inches across, and had a hole in the centre. It was colored brown."

"Well, powder is made in many forms," explained Tom. "A person who has only seen black gunpowder, with its little grains, would not believe that this was one grain of the new powder."

"That macaroni stick a grain of powder?" cried Ned.

"Yes, we'll call it a grain," went on the young inventor, "just as the brown, hexagonal cube you saw was a grain. You see, Ned, the idea is to explode all the powder at once—to get instantaneous action. It must all burn up at once as soon as it is detonated, or set off.

"To do that you have to have every grain acted on at the same moment, and that could not be done if the powder was in one solid chunk, or closely packed. For that reason they make it in different shapes, so it will lie loose in the firing chamber, just as a lot of jack-straws are piled up. In fact, some of the new powder looks like jack-straws. Some, as this, for instance, looks like macaroni. Other is in cubes, and some in long strings."

As he spoke Tom struck a match and held the flames near the end of one of the "macaroni" sticks.

"Caesar's grandmother!" yelled Ned. "Are you crazy, Tom?" as he started to leap for a window.

"Don't get excited," spoke Tom, quietly. "There's no danger," and he actually set fire to the stick of queer powder, which burned like some wax taper.

"But—but—" stammered Ned.

"It is only when powder is confined that it explodes," Tom explained. "If it can burn in the open it's as harmless as water, provided you don't burn too much at once. But put it in something where the resulting gases accumulate and can't escape, and then— why, you have an explosion—that's all."

"Yes—that's all," remarked Ned, grimly, as he nervously watched the burning stick of powder. Tom let it flame for a few seconds, and then calmly blew it out.

"You know what a little puff black gunpowder gives, if you burn some openly on the ground," went on Tom; "don't you, Ned?"

"Sure, I've often done that."

"But put that same powder in a tight box, and set fire to it, and you have a bang instead of a puff. It's the same way with this powder, only it doesn't even puff, for it burns more slowly.

"An explosion, you see, is the sudden liberation at one time of the gases which result when the powder is burned. If the gases are given off gradually, and in the open, no harm is done. But put a stick like this in, say, a steel box, all closed up, save a hole for the fuse, and what do you have? An explosion. That's the principle of all guns and cannon.

"But say, Ned, I'm getting to be a regular lecturer. I didn't know I was running on so. Why didn't you stop me?"

"Because I was interested. Go on, tell me some more."

"Not now. I want to get this powder in a safe place. I'm a little nervous about it after that fire. You see if it had caught, when tightly packed in the boxes, there would have been a terrific explosion, though it does burn so harmlessly in the open air. Now let me see—"

Tom was interrupted by the postman's whistle, and a little later Eradicate came in with the mail that had been left in the box at the shop door. Tom rapidly looked over the letters.

"Here's the note I want, I think," he said, selecting one. "Yes, this is it. 'Permission is hereby granted,' he read, 'to Thomas Swift to visit,' and so on, and so on. This is the stuff, Ned!" he cried.

"What is it?"

"A permit to visit the government proving grounds at Sandy Hook, Ned, and see 'em test that new big gun I was telling you about. Hurray! We'll go down there, and I'll see how my ideas fit in with those of the government's experts."

"Did you say 'we' would go down, Tom?"

"I sure did. You'll go with me; won't you?"

"Well, I hadn't thought very much about it, but I guess I will. When is it?"

"A week from today, and I'm going to need all that time to get ready. Now let's get busy, and we'll arrange to go to Sandy Hook. I've had trouble enough to get this permit—I guess I'll put it where it won't get lost," and he locked it in a secret drawer of his desk.

Then the lads stored the powder in a safe place, and soon were busy about several matters in the shop.

CHAPTER V. OFF TO SANDY HOOK

"What's the idea of this government test of the big gun, Tom?" asked Ned. "I got so excited about that near-explosion the other day, that I didn't think to ask you all the particulars."

"Why, the idea is to see if the gun will work, and do all that the inventor claims for it," was the answer. "They always put a new gun through more severe tests than anything it will be called on to stand in actual warfare. They want to see just how much margin of safety there is."

"Oh I see. And is this one of the guns that are to be used in fortifying the Panama Canal?"

"Well, Ned, I don't know, exactly. You see, the government isn't telling all its secrets. I assume that it is, and that's why I'm anxious to see what sort of a gun it is."

"As a matter of fact, I'm going into this thing on a sort of chance, just as dad did when he invested in Mr. Peterson's opal mine."

"Do you think anything will come of that, Tom?"

"I don't know. If we get down to Panama, after I have made my big gun, we may take a run over, and see how he is making out. But, as I said, I'm going into this big cannon business on a sort of gamble. I have heard, indirectly, that Uncle Sam intends to use a new type of gun in fortifying the Panama Canal. It's about forty-nine miles long, you know, and it will take many guns to cover the whole route, as well as to protect the two entrances."

"Not so very many if you make a gun that will shoot thirty miles," remarked Ned, with a smile.

"I'm not so sure I can do it," went on Tom. "But, even at that, quite a number of guns will be needed. For if any foreign nation, or any combination of nations, intend to get the canal away from us, they won't make the attack from one point. They'll come at us seven different ways for Sunday, and I've never heard yet of a gun that can shoot seven ways at once. That's why so many will be needed.

"But, as I said, I don't know just what type the Ordnance Department will favor, and I want to get a line. Then, even if I invent a cannon that will outshoot all the others, they may not take mine. Though if they do, and buy a number of them, I'll be more than repaid for my labor, besides having the satisfaction of helping my country."

"Good for you, Tom! I wish it was time to go to Sandy Hook now. I'm anxious to see that big gun. Do you know anything about it?"

"Not very much. I have heard that it is not quite as large as the old sixteen-inch rifle that they had to throw away because of some trouble, I don't know just what. It was impractical, in spite of its size and great range. But this new gun they are going to test is considerably smaller, I understand.

"It was invented by a General Wailer, and is, I think, about twelve inches across at the muzzle. In spite of that comparatively small size, it fires a projectile weighing a thousand pounds, or half a ton, and takes five hundred pounds of powder. Its range, of course, no one knows yet, though I have heard it said that General Wailer claims it will shoot twenty miles."

"Whew! Some shot!"

"I'm going to beat it," declared Tom, "and I want to do it without making such a monstrous gun that it will be difficult to cast it.

"You see, Ned, there is, theoretically, nothing to prevent the casting of a steel rifled cannon that would be fifty inches across at the muzzle, and making it a hundred feet long. I mean it could be done on paper—figured out and all that. But whether you would get a corresponding increase in power or range, and be able to throw a relatively larger projectile, is something no one knows, for there never has been such a gun made. Besides, the strain of the big charge of powder needed would be enormous. So I don't want merely to make a giant cannon. I want one that will do a giant's work, and still be somewhere in the middle-sized class."

"I see. Well, you'll probably get some points at Sandy Hook."

"I think so. We go day after tomorrow."

"Is Mr. Damon going?"

"I think not. If he does I'll have to get another pass, for mine only calls for two persons. I got it through a Captain Badger, a friend of mine, stationed at the Sandy Hook barracks. He doesn't have anything to do with

the coast defense guns, but he got the pass to the proving grounds for me."

Tom and his chum talked for some time about the prospects for making a giant cannon, and then the young inventor, with Ned's aid, made some powder tests, using some of the explosive that had so nearly caught fire.

"It isn't just what I want," Tom decided, after he had put small quantities in little steel bombs, and exploded them, at a safe distance, and under a bank of earth, by means of an electric primer.

"Why, Tom, that powder certainly burst the bombs all to pieces," said Ned, picking up a shattered piece of steel.

"I know, but it isn't powerful enough for me. I'm going to send for samples of another kind, and if I can't get what I want I'll make my own powder. But come on now, this stuff gives me a headache. Let's take a little flight in the Humming Bird. We'll go see Mr. Damon," and soon the two lads were in the speedy little monoplane, skimming along like the birds. The fresh air soon blew away their headaches, caused by the fumes from the nitro-glycerine, which was the basis of the powder. Dynamite will often produce a headache in those who work with it.

Two days later Tom and Ned set off for Sandy Hook.

This long, neck-like strip of land on the New Jersey coast is, as most of you know, one of the principal defenses of our country.

Foreign vessels that steam into New York harbor first have to pass the line of terrible guns that, back of the earth and concrete defenses, look frowningly out to sea. It is a wonderful place.

On the Sandy Hook Bay side of the Hook there is a life-saving station. Right across, on the sea side, are the big guns. Between are the barracks where the soldiers live, and part of the land is given over to a proving ground, where many of the big guns are taken to be tested.

Tom and Ned reached New York City without incident of moment, and, after a night spent at a hotel, they went to the Battery, whence the small government steamer leaves every day for Sandy Hook. It is a trip of twenty-one miles, and as the bay was rather rough that day, Tom and Ned had a taste of a real sea voyage. But they were too experienced travelers to mind that, though some other visitors were made quite ill.

A landing was made on the bay side of the Hook, it being too rough to permit of a dock being constructed on the ocean side.

"Now we'll see what luck we have," spoke Tom, as he and Ned, inquiring the way to the proving grounds from a soldier on duty, started for them. On the way they passed some of the fortifications.

"Look at that gun!" exclaimed Ned, pointing to a big cannon which seemed to be crouched down in a sort of concrete pit. "How can they fire that, Tom? The muzzle points directly at the stone wall. Does the wall open when they want to fire?"

No, the gun raises up, peeps over the wall, so speak, shoots out its projectile, and then crouches down again."

"Oh, you mean a disappearing gun."

"That's it, Ned. See, it works by compressed air," and Tom showed his chum how, when the gun was loaded, the projectile in place, and the breech-block screwed fast, the officer in charge of the firing squad would, on

getting the range from the soldier detailed to calculate it, make the necessary adjustments, and pull the lever.

The compressed air would fill the cylinders, forcing the gun to rise on toggle-jointed arms, so that the muzzle was above the bomb-proof wall. Then it would be fired, and sink back again, out of sight of the enemy.

The boys looked at several different types of big rifled cannon, and then passed on. They could hear firing in the distance, some of the explosions shaking the ground.

"They're making some tests now," said Tom, hurrying forward.

Ned followed until, passing a sort of machine shop, the lads came to where a sentry paced up and down a concrete walk.

"Are these the proving grounds?" asked Tom. "This is the entrance to them," replied the soldier, bringing his rifle to "port," according to the regulations. "What do you want?"

"To go in and watch the gun tests," replied Tom. "I have a permit," and he held it out so the soldier could see it.

"That permit is no good here;" the sentry exclaimed.

"No good?" faltered Tom.

"No, it has to be countersigned by General Wailer. And, as he's on the proving grounds now, you can't see him. He's getting ready for the test of his new cannon."

"But that's just what we want to see!" cried Tom. "We want to get in there purposely for that. Can't you send word to General Wailer?"

"I can't leave my post," replied the sentry, shortly. "You'll have to come another time, when the General isn't busy. You can't get in unless he countersigns that permit."

"Then it may be too late to witness the test," objected the young inventor. "Isn't there some way I can get word to him?"

"I don't think so," replied the sentry. "And I'll have to ask you to leave this vicinity. No strangers are allowed on the proving grounds without a proper pass."

CHAPTER VI. TESTING THE WALLER GUN

Tom looked at Ned in dismay. After all their work and planning, to be thus thwarted, and by a mere technicality! As they stood there, hardly knowing what to do, the sound of a tremendous explosion came to their ears from behind the big pile of earth and concrete that formed the bomb-proof around the testing ground.

"What's that?" cried Ned, as the earth shook.

"Just trying some of the big guns," explained the sentry, who was not a bad-natured chap. He had to do his duty. "You'd better move on," he suggested. "If anything happens the government isn't responsible, you know."

"I wish there was some way of getting in there," murmured Tom.

"You can see General Waller after the test, and he will probably countersign the permit," explained the sentry.

"And we won't see the test of the gun I'm most interested in," objected Tom. "If I could only—"

He stopped as he noticed the sentry salute someone coming up from the rear. Tom and Ned turned to behold a pleasant-faced officer, who, at the sight of the young inventor, exclaimed:

"Well, well! If it isn't my old friend Tom Swift! So you got here on my permit after all?"

"Yes, Captain Badger," replied the lad, and then with a rueful face he added: "But it doesn't seem to be doing me much good. I can't get into the proving grounds."

"You can't? Why not?" and he looked sharply at the sentry.

"Very sorry, sir," spoke the man on guard, "but General Waller has left orders, Captain Badger, that no outsiders can enter the proving grounds when his new gun is being tested unless he countersigns the permits. And he's engaged just now. I'm sorry, but—"

"Oh, that's all right, Flynn," said Captain Badger. "It isn't your fault, of course. I suppose there is no rule against my going in there?" and he smiled.

"Certainly not, sir. Any officer may go in," and the guard stepped to one side.

"Let me have that pass, Tom, and wait here for me," said the Captain. "I'll see what I can do for you," and the young officer, whose acquaintance Tom had made at the tests when the government was purchasing some aeroplanes for the army, hurried off.

He came back presently, and by his face the lads knew he had been successful.

"It's all right," he said with a smile. "General Waller countersigned the pass without even looking at it. He's so excited over the coming test of his gun that he hardly knows what he is doing. Come on in, boys. I'll go with you."

"Then they haven't tested his gun yet?" Asked Tom, eagerly, anxious to know whether he had missed anything.

"No, they're going to do so in about half an hour. You'll have time to look around a bit. Come on," and showing the sentinel the counter-signed pass, Captain Badger led the two youths into the proving grounds.

Tom and Ned saw so much to interest them that they did not know at which to look first. In some places officers and firing squads were testing small-calibre machine guns, which shot off a round with a noise like a string of firecrackers on the Chinese New Year's. On other barbettes larger guns were being tested, the noise being almost deafening.

"Stand on your tiptoes, and open your mouth when you see a big cannon about to be fired," advised Captain Badger, as he walked alongside the boys.

"What good does that do?" inquired Ned.

"It makes your contact with the earth as small as possible— standing on your toes," the officer explained, "and so reduces the tremor. Opening your mouth, in a measure, equalizes the changed air pressure, caused by the vacuum made when the powder explodes. In other words, you get the same sort of pressure down inside your throat, and in the tubes leading to the ear—the same pressure inside, as outside.

"Often the firing of big guns will burst the ear drums of the officers near the cannon, and this may often be prevented by opening the mouth. It's just like going through a deep tunnel, or sometimes when an elevator descends quickly from a great height. There is too much outside air pressure on the ear drums. By opening your mouth and swallowing rapidly, the pressure is nearly equalized, and you feel no discomfort."

The boys tried this when the next big gun was fired, and they found it true. They noticed quite a crowd of officers and men about a certain large barbette, and Captain Badger led them in that direction.

"Is that General Wailer's gun?" asked Tom.

"That's where they are going to test it," was the answer.

Eagerly Tom and Ned pressed forward. No one of the many officers and soldiers grouped about the new cannon seemed to notice them. A tall man, who seemed very nervous and excited, was hurrying here and there, giving orders rapidly.

"How is that range now?" he asked. "Let me take a look! Are you sure the patrol vessels are far enough out? I think this projectile is going farther than any of you gentlemen have calculated."

"I believe we have correctly estimated the distance," answered someone, and the two entered into a discussion.

"That excited officer is General Wailer," explained Captain Badger, in a low voice, to Tom and Ned.

"I guessed as much," replied the young inventor. Then he went closer to get a better look at the big cannon.

I say big cannon, and yet it was not the largest the government had. In fact, Tom estimated the calibre to be less than twelve inches, but the cannon was very long—much longer in proportion than guns of greater muzzle diameter. Then, too, the breech, or rear part, was very thick and heavy.

"He must be going to use a tremendous lot of powder," said Tom.

"He is," answered Captain Badger. "Some of us think he is going to use too much, but he says it is impossible to burst his gun. He wants to make a long-range record shot, and maybe he will."

"That's a new kind of breech block," commented Tom, as he watched the mechanism being operated.

"Yes, that's General Waller's patent, too. They're going to fire soon."

I might explain, briefly, for the benefit of you boys who have never seen a big, modern cannon, that it consists of a central core of cast steel. This is rifled, just as a small rifle is bored, with twisted grooves throughout its length. The grooves, or rifling, impart a twisting motion to the projectiles, and keep them in a straighter line.

After the central core is made and rifled, thick jackets of steel are "shrunk" on over the rear part of the gun. Sometimes several jackets are put on, one over the other, to make the gun stronger.

If you have ever seen a blacksmith put a tire on a wheel you will understand what I mean. The tire is heated, and this expands it, or makes it larger. It is put on hot, and when it cools it shrinks, getting smaller, and gripping the rim of the wheel in a strong embrace. That is what the jackets of steel do to the big guns.

A big rifled cannon is loaded from the rear, or breech, just as is a breech-loading shotgun or rifle. That is, the cannon is opened at the back and the projectile is put in by means of a derrick, for often the projectiles weigh a thousand pounds or more. Next comes the powder—hundreds of pounds of it—and then it is necessary to close the breech.

The breech block does this. That block is a ponderous piece of steel, quite complicated, and it swings on a hinge fastened to one side of the rear of the gun. Once it is swung back into place, it is made fast by means of screw threads, wedges or in whatever way the inventor of the gun deems best.

The breech block must be very strong, and held firmly in place, or the terrific force of the powder would blow it out, wreck the gun and kill those behind it. You see, the breech block really stands a great part of the strain. The powder is between it and the projectile, and there is a sort of warfare to see which will give way—the projectile or the block. In most cases the projectile gracefully bows, so to speak, and skips out of the muzzle of the gun, though sometimes the big breech block will be shattered.

With eager eyes Tom and Ned watched the preparations for firing the big gun. The charge of powder was hoisted out of the bomb-proof chamber below the barbette, and then the great projectile was brought up in slings. At the sight of that Tom realized that the gun was no ordinary one, for the great piece of steel was nearly three feet long, and must have weighed nearly a thousand pounds. Truly, much powder would be needed to send that on its way.

"I'm afraid, General, that you are using too much of that strong powder," Tom heard one officer say to the inventor of the gun. "It may burst the breech."

"Nonsense, Colonel Washburn. I tell you it is impossible to burst my gun—impossible, sir! I have allowed for every emergency, and calculated every strain. I have a margin of safety equal to fifty per cent."

"Very well, I hope it proves a success."

"Of course it will. It is impossible to burst my gun! Now, are we ready for the test?"

The gun was rather crude in form, not having received its final polish, and it was mounted on a temporary carriage. But even with that Tom could see that it was a wonderful weapon, though he thought he would have put on another jacket toward the muzzle, to further strengthen that portion.

"I'm going to make a gun bigger than that," said Tom to Ned. He spoke rather louder than he intended, and, as it was at a moment when there was a period of silence, the words carried to General Waller, who was at that moment near Tom.

"What's that?" inquired the rather fiery-tempered officer, as he looked sharply at our hero.

"I said I was going to make a larger gun than that," repeated Tom, modestly.

"Sir! Do you know what you are saying? How did you come in here, anyhow? I thought no civilians were to be admitted today! Explain how you got here!"

Tom felt an angry flush mounting to his cheeks.

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